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BIOSTRATIGRAPHY AND LOWER PERMIAN FUSULINIDAE
OF THE UPPER DELTA RIVER AREA,
EAST CENTRAL ALASKA RANGE

A

DISSERTATION

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BIOSTRATIGRAPHY AND LOWER PERMIAN FUSULINIDAE

OF THE UPPER DELTA RIVER AREA,

EAST CENTRAL ALASKA RANGE

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ABSTRACT

A Lower Permian fusulinid fauna was found in rocks of Mankomen age within a fault block in the Upper Delta River area, east central Alaska Range. Three members of the Mankomen Formation are recognized and described from this area. They are, in stratigraphic order: a lower Tuffaceous Sandstone Member, an Alternating Limestone-Shale Member, and a Limestone Member. Additional sedimentary rocks occur still higher in the section but are as yet unmapped. The section exposed in this area represents the youngest known Upper Paleozoic sediments known in the Alaska Range.

Eighteen species of fusulinids belonging to three genera were described from the Alternating Limestone-Shale Member and Limestone Member. They are: Pseudofusulinella valkenburghae n. sp., P. cf. P. parvula Skinner and Wilde, P. sp. A, Eoparafusulina mendenhalli n. sp., E. waddelli n. sp., Schwagerina pseudokaragasensis n. sp., S. cf. S. emaciata (Beede), S. sp. A, S. rowetti n. sp., S. callosa (Rauser-Chernousova), S. whartoni n. sp., S. heineri n. sp., S. moffiti n. sp., S. sp. B, S. sp. C, S. rainyensis n. sp., S. mankomenensis n. sp., and S. hyperborea (Salter). This fauna was divided into six assemblage zones on the basis of the fusulinid species. Collectively, the zones indicate a Lower Permian age, ranging from late Asselian to middle Artinskian when compared to the zonation of Permian sections in the western Urals, U.S.S.R.

The fusulinids from the Lower Permian of the Alaska Range belong to the Boreal faunal realm that includes the geosynclinal seas of the Alaskan Cordilleran, Franklinian, and Uralian geosynclines. Faunal evidence indicates temporary marine connections between Alaska and the Pacific northwest, and between the Urlian and Tethyan regions.

Correlations are suggested between the Alaska Range section and the following regions: southeastern Alaska; northeastern Alaska; northwestern Yukon Territory; Grinnell Peninsula, Arctic Archipelago, northwest Greenland, Spitsbergen; and the Ural region of the U.S.S.R.

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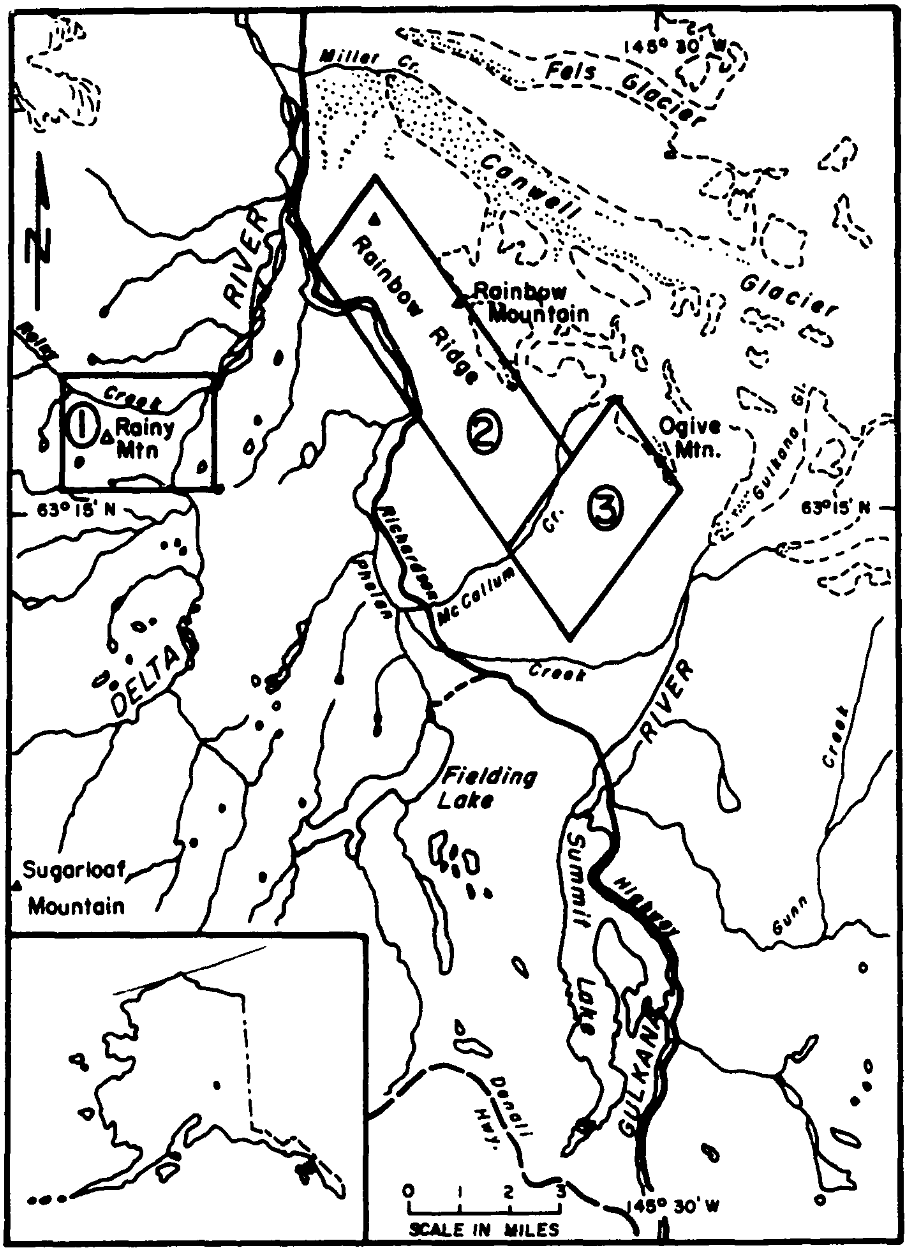
INTRODUCTION

Eighteen species of Lower Permian fusulinids were described from rocks equivalent to the Mankomen Formation in the east central Alaska Range (Text-fig. 1). This fauna has both regional and local importance. Close similarities exist between this fauna and those of the Canadian Arctic (Harker and Thorsteinsson, 1960), northern Yukon Territory (Ross, 1967b), the Ural region of the U.S.S.R. (Rauser-Chernousova, 1935, 1940, 1965; Korzhenevsky, 1940), northern California (Skinner and Wilde, 1965), and other areas in Alaska (Dunbar, 1946; Skinner and Wilde, 1966a). Relationships with the fusulinid faunas of Greenland and Spitsbergen are less clearly defined. They nevertheless support intermittent marine connections between the Uralian, Franklinian, and Cordilleran areas during early Permian time. The six fusulinid assemblage zones which I have defined from the Upper Delta River area undoubtedly will form a basis for stratigraphic control in other areas in the Alaska Range where Lower Permian rocks occur.

Acknowledgments

I am indebted to my research supervisor, Dr. C.L. Rowett, for advise and assistance during all phases of this study. I also wish to thank Dr. D.E. Waddell, Houston, Texas, for invaluable assistance and comments



Text-fig. 1 - Location map, east central Alaska Range. 1, Upper Delta River area (study area); 2, Rainbow Mountain area; 3, McCallum Creek-West Gulkana Glacier area.

regarding fusulinid taxonomy, and Mr. L.E. Heiner, M.I.R.L., University of Alaska, for helpful suggestions on the statistical aspects of the study and for writing the computer programs utilized in this report. I am grateful to Dr. C.M. Hoskin for advice and assistance with the photography and to the other members of my doctoral committee, Dr. R.D. Guthrie and Mrs. F.L. Weber, and also to Dr. L.G. Swartz, who critically read the manuscript.

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I wish to express my appreciation to the following individuals for assistance, both technical and logistical, during the field study: Mr. and Mrs. J.D. Lanni of Summit Lake Lodge; Mr. G. Gryc, Chief, Alaskan Geology Branch, U.S. Geological Survey; Mr. I.L. Tailleur, U.S. Geological Survey; Mr. L.M. Anthony of the Tennessee Corporation; and Mr. J.R. Henry, Jr., my field assistant. Thanks are also due to Miss J. Van Valkenburgh for her assistance as laboratory technician, and to Mrs. L.E. Heiner for typing the manuscript.

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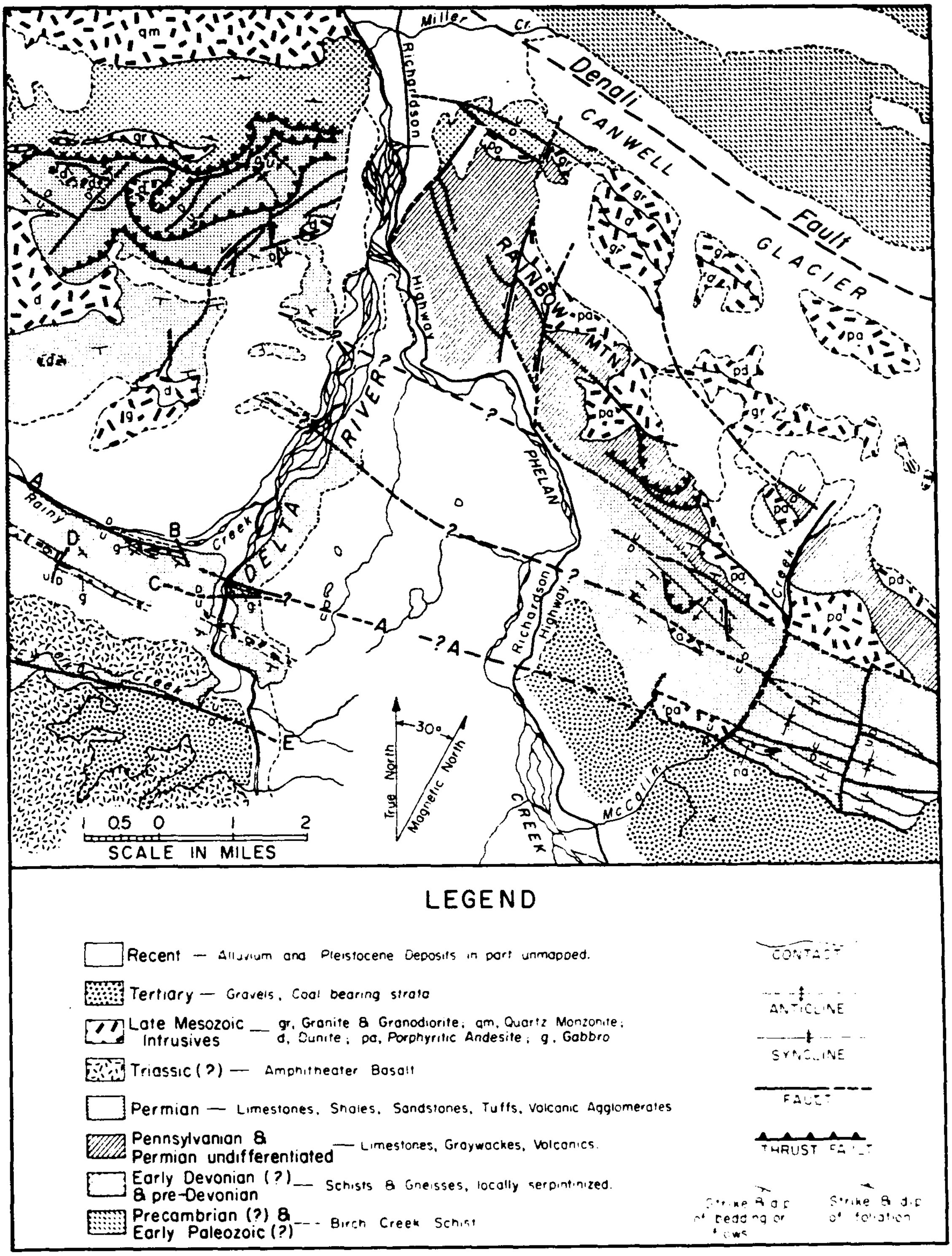
GENERAL GEOLOGY OF THE EAST CENTRAL ALASKA RANGE

The general geologic relations in the east central Alaska Range are shown in Text-fig. 2, in which only major rock units are differentiated. Surficial glacial deposits and minor faults and fold axes are omitted.

The Denali fault, one of the major structural features in Alaska, is traceable for more than 1000 miles along the length of the Alaska Range. This fault, or fault zone, controls the position of Canwell Glacier in the northeast corner of the map (Text-fig. 2). The Denali fault zone divides the Alaska Range into two major geologic provinces. The Precambrian and the Lower Paleozoic (?) Birch Creek Schist occurs north of the fault, while Lower Devonian (?) and pre-Devonian metamorphics, Permo-Carboniferous volcanics and sedimentary rocks, and Mesozoic deposits occur to the south. Tertiary clastics and coal-bearing units are preserved along both the north and south flanks of the Alaska Range. Many of these units were intruded by basic and ultrabasic dikes and sills, and granitic plutons during the late Mesozoic and early Tertiary.

Low-angle, north-dipping thrust faults are present in the northwest part of the map area. These thrusts bring Devonian (?) and pre-Devonian metamorphics southwestward over late Paleozoic (lower Pennslyvanian (?) and lower Permian) sedimentary and volcanic strata. High-angle block faults are also common and strike northeastward. Major fold axes also generally



Text-fig. 2 - Geologic map of the east central Alaska Range. (After Hanson, 1963; Bond, 1965; Stout, 1965; Rose, 1966; and Rowett, in press; additions by the author.)

parallel the block faults. Many of these structures are transected by smaller cross-faults.

For more detailed information on this area, the reader is referred to Mendenhall (1900, 1905), Moffit (1912, 1942, 1954), Hanson (1963), Bond (1965), Stout (1965), Rose (1965, 1966), Richter (1966), and Rowett (in press).

GEOLOGY OF THE UPPER DELTA RIVER AREA

Description of Major Rock Units

Igneous Rocks

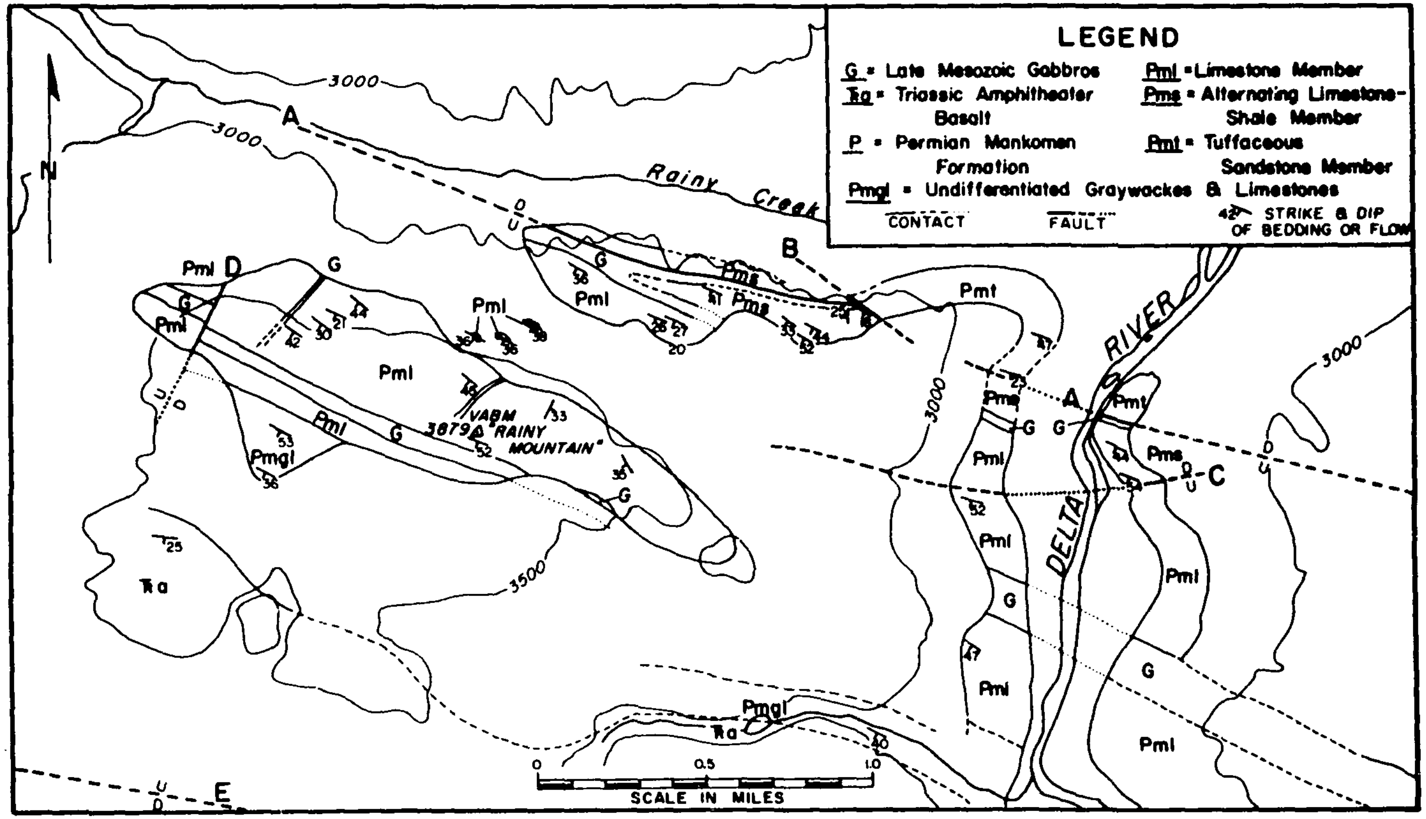
Triassic (?) Amphitheater Basalt (Tra)

Triassic (?) basaltic flows are widespread in the southern part of this area. Rose (1965, p. 11) indicated that a few agglomerates and tuffs, which in part consist of albitized basalt, also may be present. He suggested that these flows may be correlative with the Triassic Nikolai Greenstone of the southern Copper River Basin (Schrader and Spencer, 1901, p. 36), approximately 50 miles southeast of the study area.

Mesozoic Gabbros (G)

Mesozoic basic intrusives occur as dikes and sills and all are gabbroic in composition. According to Rose (1965, p. 15), these gabbros contain about 50 percent mafic minerals, but mineralogy is more varied in the larger igneous bodies.

The intrusive rocks exposed immediately south of Rainy Creek and on both sides of the Delta River in the northern part of the study area is controlled in part by Fault A (Text-fig. 3). Serpentinization occurs on the



Text-fig. 3 - Geologic map of Upper Delta River area (modified after Rose, 1966).

wall rock of the lower discordant branch, which suggests that the intrusion post-dated the fault. The upper branch diverges from the main dike and locally appears to be sill-like.

A sill is exposed along the crest of Rainy Mountain for a distance of almost one mile. It is probably related to the gabbros occurring along the Delta River in the southern part of the mapped area (Text-fig. 3). However, intervening exposures are mostly covered.

Localized leaching of calcareous sedimentary rocks occurs where sills and dikes are in contact with country rock. Two apophyses of the sill located on the north side of Rainy Mountain also caused some alteration of adjacent limestones. Similar hypabyssal rocks are common to the west and north of the study area (Rose, 1965, p. 15-16; Stout, 1965, p. 35-39). Field relationships in these areas suggest that there may have been two periods of basic intrusions, Mesozoic and early Tertiary in age (Rose, 1966, p. 15).

Permian Sedimentary Rocks: Mankomen Formation

The Lower Permian sedimentary rocks in the Upper Delta River area are lateral equivalents of the Mankomen Formation. This formation usefully can be divided into three members in the study area. In ascending stratigraphic order these are: (1) a Tuffaceous Sandstone Member (Pmt); (2) an Alternating Limestone-Shale Member (Pms); and (3) a Limestone Member (Pml). A thick overlying succession of "graywackes" and limestones (Pmgl) are as yet incompletely mapped and have not been differentiated.

Tuffaceous Sandstone Member (Pmt)

The Tuffaceous Sandstone Member is exposed along the south side of Rainy Creek and in a west-facing bluff east of the Delta River (Text-fig. 3). Lithology consists of fine-grained, green to maroon silicified tuffs, silicified light green mudstones, and coarse-grained, volcanic-rich arkosic sandstones. One or more thin andesite flows are present. This member is in fault contact with the overlying unit in the Upper Delta River area, but in the West Gulkana Glacier area, approximately ten miles to the southeast, this contact is gradational and conformable.

Dr. C.M. Hoskin (personal communication) examined a thin section from a sample taken from the contact zone above West Gulkana Glacier and classified the rock a climatic arkose (Folk, 1965, p. 120). The arkose is highly mature and in addition, contains glauconite and small amounts of volcanic material and fossil fragments. Clays and other products of chemical weathering are absent.

I did not process any samples from this member for faunal content, however, the fusulinid associations that occur above and below the tuffaceous member indicate that it is probably Asselian in age.

Alternating Limestone-Shale Member (Pms)

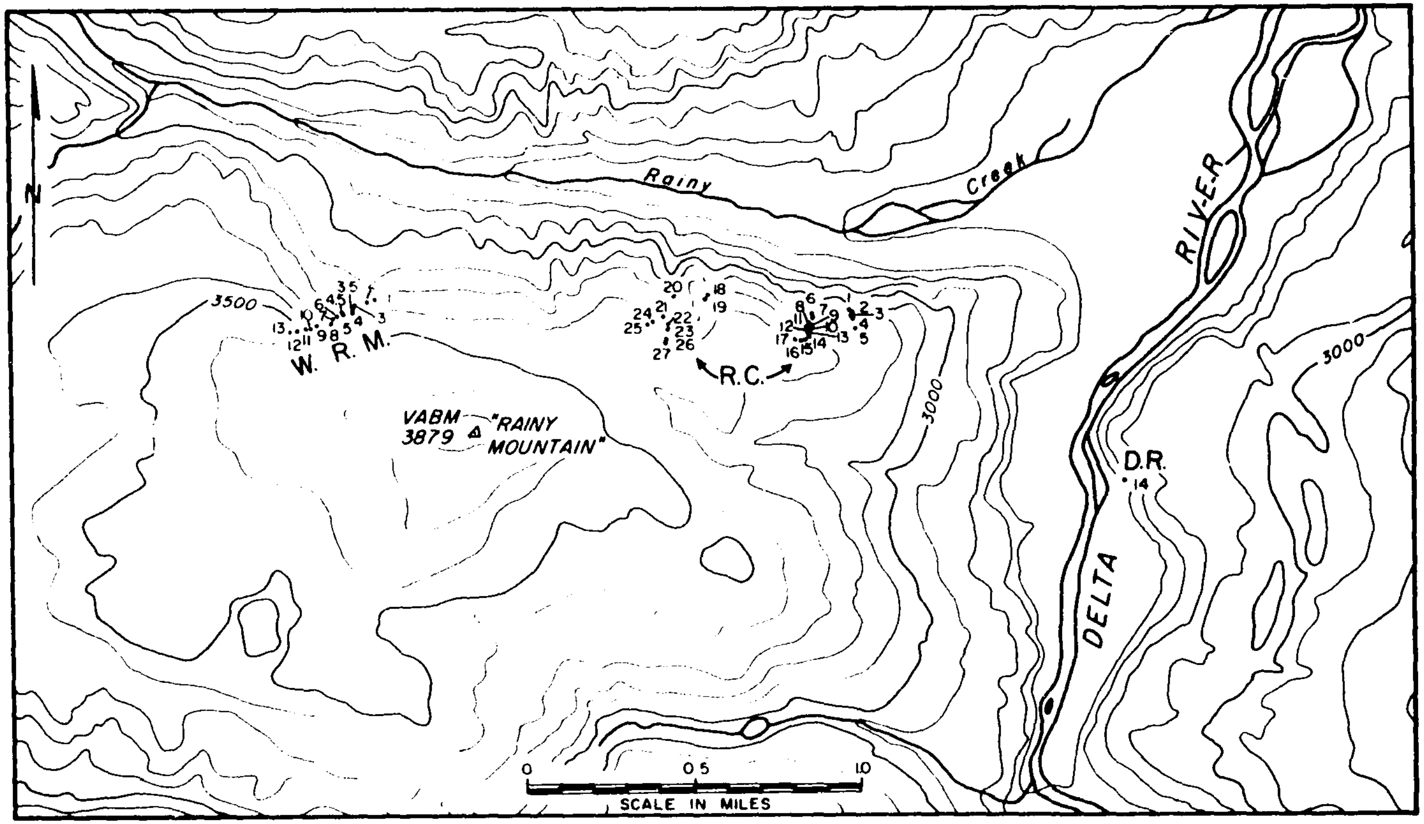
The overlying Alternating Limestone-Shale Member is well exposed in north-facing bluffs along the south side of Rainy Creek and between Faults A and C on the east bank of the Delta River (Text-fig. 3). This member consists predominantly of alternating beds of volcanic-rich, calcareous sandstones, bioclastic limestones, and black shales. Individual beds typically are from one to three feet thick and are rust-colored on weathered surface. Carbonates that were analyzed petrographically were variously classified biomicrites (Folk, 1962) (Hoskin, Kerin, and Nelson, personal communication). Crinoid, bryozoan, and brachiopod fragments are the dominant biogenic constituents in the limestones. Dolomitization generally is not extensive in this part of the section, but in one sample (RC-9, 287 feet from the base of the section) more than 50 percent of the rock is composed of secondary dolomite. Volcanic and arenaceous material decreases in the upper part of the member.

Fusulinid assemblage zones A, B, and C (Table 1, Text-figs. 4 and 6) occur in the lower 584 feet of this member, indicating an age ranging from late Asselian through Sakmarian.

The first appearance of Schwagerina moffiti n. sp. occurs in sample RC-20, 625 feet above the base of this section. This species is more advanced than typical Sakmarian forms of the genus and is here considered to be no older than early Artinskian. The Sakmarian-Artinskian boundary in

Alternating Limestone-Shale Member (Pms)																					Limestone Member (Pml)																						
39.9	43.1	50.3	84.0	136.5	160.5	187.7	260.6	287.1	298.6	317.2	326.2	373.8	392.3	412.1	412.1	451.0	488.1	541.8	584.0	625.4	776.0	801.1	827.0	886.1	956.3	968.6	980.6	1631.0	1656.3	1704.6	1731.5	1744.5	1776.3	1778.3	1822.8	1832.5	1867.3	1885.3	1904.2	1967.6	2011.1	2083.9	Feet Above Base of Section
RC-1	RC-2	RC-3	RC-4	RC-5	RC-6	RC-7	RC-8	RC-9	RC-10	RC-11	RC-12	RC-13	RC-14	RC-15	DR-14	RC-16	RC-17	RC-18	RC-19	RC-20	RC-21	RC-22	RC-23	RC-24	RC-25	RC-26	RC-27	WRM-1	WRM-2	WRM-3	WRM-3.5	WRM-4	WRM-4.5	WRM-5	WRM-6	WRM-7	WRM-8	WRM-9	WRM-10	WRM-11	WRM-12	WRM-13	Sample Number
																																											Species
1	2	3	1	2		2		1	1																																		*Pseudofusulinella* sp. A
										16																																	*Pseudofusulinella valkenburghae* n. sp.
												4																															*Pseudofusulinella* cf. *P. parvula* n. sp.
														1																													*Pseudofusulinella* sp.
													6	47	66	3	5																										*Eoparafusulina mendenhalli* n. sp.
																		6	34																								*Eoparafusulina waddelli* n. sp.
							4	1				3																															*Schwagerina* sp. A
							1	10																																			*Schwagerina pseudokaragasensis* n. sp.
									10	5																																	*Schwagerina* cf. *S. emaciata* (Beede)
										10	17			6	1																												*Schwagerina whartoni* n. sp.
												4	1			1	1		3																								*Schwagerina callosa* (Rauser-Chernousova)
														2	3	7	2																										*Schwagerina rowetti* n. sp.
																				9	?																						*Schwagerina moffiti* n. sp.
																					?	52	6																				*Schwagerina heineri* n. sp.
																							3																				*Schwagerina* sp. B
																						1																					? *Schubertella* sp.
																								?	1	2	4																*Schwagerina* sp. C
																												?	6	?					4	3		2	?				*Schwagerina rainyensis* n. sp.
																														8	2		1				1		?				*Schwagerina mankomenensis* n. sp.
																														5			4				3		?				*Schwagerina hyperborea* (Salter)
A							B						C							D				E				F															Assemblage Zones

Table 1. Stratigraphic distribution and zonation of fusulinids. Numbers in body of table indicate number of thin sections prepared per species per sample.



Text-fig. 4 - Sample localities, Upper Delta River area.

the study area therefore is believed to lie between samples RC-19 and RC-20 in the Alternating Limestone-Shale Member. There is no evidence of a depositional break of any kind within this interval, which indicates that the boundary between the Sakmarian and Artinskian is conformable in this area.

The thickness of the Alternating Limestone-Shale Member as measured upward from the gabbroic dike (and Fault A) is 693 feet. However, scattered small exposures of this member also occur stratigraphically below this fault. Based on sections exposed in the West Gulkana Glacier area, the maximum thickness of Pms is on the order of 900-1000 feet.

Limestone Member (Pml)

Exposures of this member were examined and measured above Rainy Creek and along the north flank of Rainy Mountain (Text-fig. 3 and 4). Additional exposures on both the east and west banks of the Delta River are for the most part covered by vegetation.

The lowest part of this member consists of light colored bioclastic limestones which grade upward into crinoidal mudstones, thin limestones, and minor interbedded siltstones and shales (693 to 990 feet from the base of the measured section). The lower thick-bedded to massive "white" limestone differs markedly in color from the limestones of the underlying member (Pms) and lacks the arenaceous and tuffaceous material that characterizes the lower section.

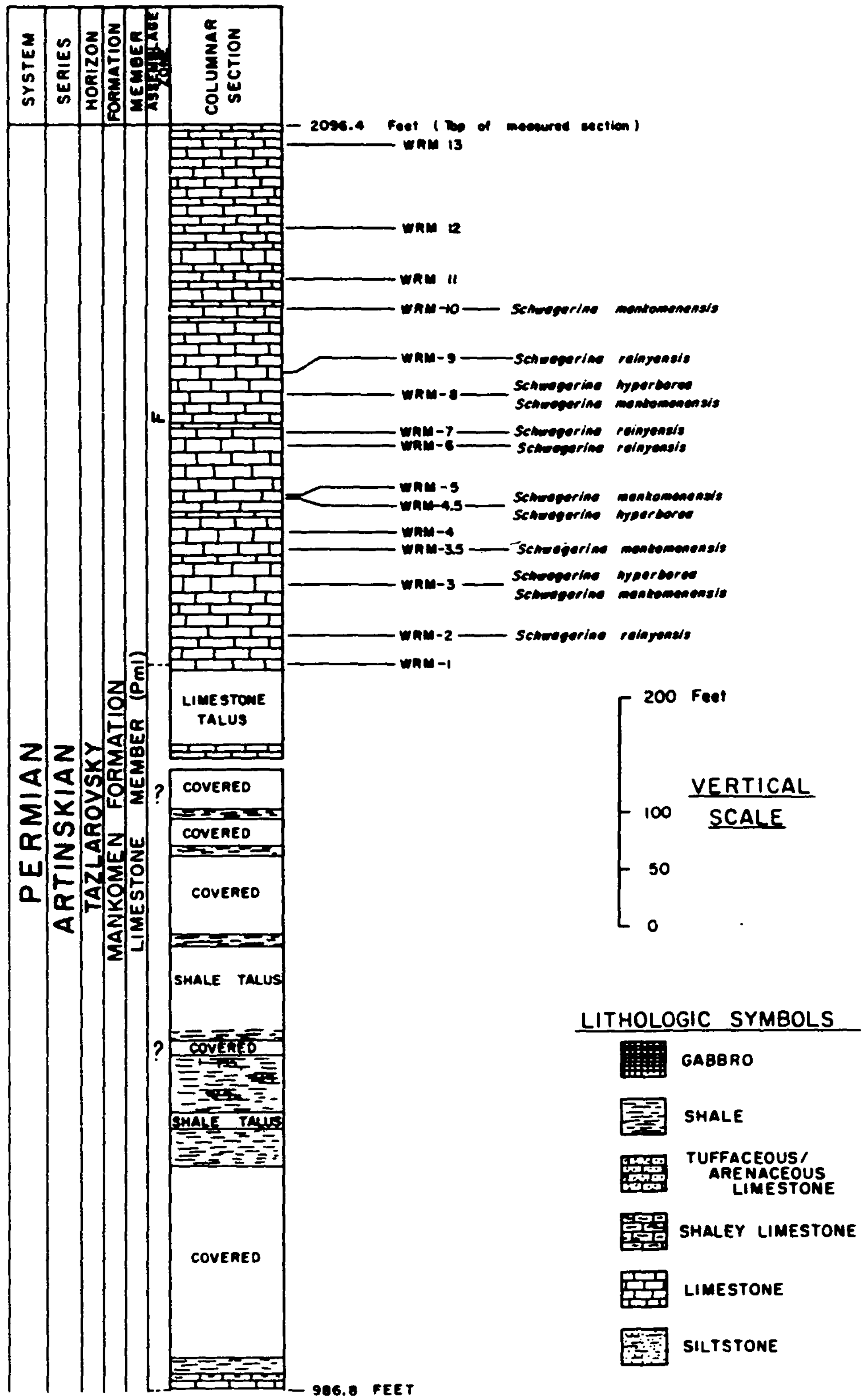
Distinctive Schwagerinas are confined to the basal part of these limestones and form two assemblage zones (D and E) (Table 1, Text-figs. 4 and 6). Brachiopods and corals are also locally present.

The middle part of this member, from 990 to 1540 feet from base of the measured section, consists of poorly exposed thinly laminated black shales and minor dark shaley limestones. No fossils were found in this portion of the section.

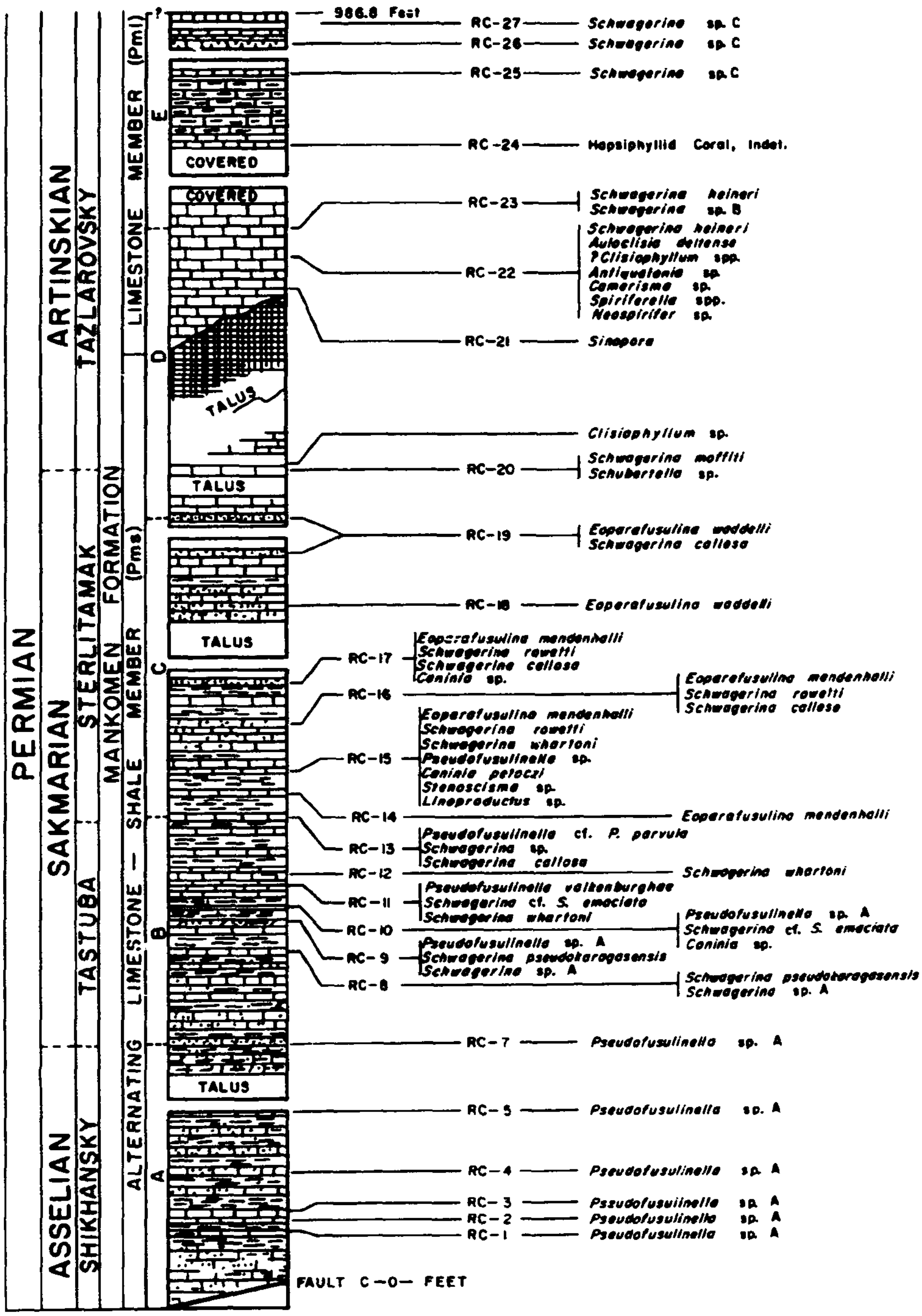
The upper part of the Limestone Member is composed of massive, bioclastic limestones that are gray to buff on weathered surfaces. Bryozoan fragments are abundant, particularly in the uppermost beds. Brachiopods are common in a few beds, but corals are uncommon to absent. Schwagerina hyperborea (Salter), S. rainyensis n. sp. and S. mankomenensis n. sp. occur in this portion of the section (Zone F) (Table 1, Text-figs. 4 and 5) and are indicative of an early to (?) middle Artinskian age. A section measured southward from the base of this member to the top of the bryozoan-bearing limestones on West Rainy Mountain was 1325 feet thick. An estimated 550 feet of additional section is present which is intruded by a gabbro sill along the crest of Rainy Mountain. The total thickness of this member thus approximates 1875 feet.

Undifferentiated "Graywackes" and Limestone (Pmgl)

This undifferentiated unit comprises the highest part of the exposed sedimentary section in the Upper Delta River area. Several hundred feet of



Text-fig. 5 - Stratigraphic section and zonal distribution of Fusulinidae in the upper part of the Upper Delta River area.



Text-fig. 6 - Stratigraphic section and zonal distribution of Fusulinidae in the lower part of the Upper Delta River section. Corals identified by C.L. Rowett; brachiopods by R.E. Grant.

interbedded graywacke sandstones and shales overlie the Limestone Member on the south slope of Rainy Mountain. These rocks are overlain by massive, white bioclastic limestones that in turn are nonconformably overlain by the (?) Triassic Amphitheater basalt in the southwestern part of the map and elsewhere (Text-fig. 3). A helicopter reconnaissance indicated that thick limestones are also exposed along Eureka Creek, the next major drainage to the south. However, an accurate estimate of the total thickness of these units can not be made at this time.

Structure

General

The Upper Delta River area consists essentially of a fault block bounded on the north and south by Faults A and E (Text-fig. 2). The trace of these high-angle faults in part controls the drainage of Rainy and Eureka Creeks. The Permian sedimentary rocks exposed in this fault block strike northwest and dip from 20° to 54° southwest. Local steepening of dip occurs adjacent to faults.

Minor anticlinal flexures occur in the Alternating Limestone-Shale Member along Rainy Creek, and in the Limestone Member on the north-facing slope of Rainy Mountain. The axes of these small folds are perpendicular to the main structural trend and are similar to folds described by Bond (1965, p. 9-11) in correlative strata six to ten miles to the east. These minor folds are not shown on the accompanying maps (Text-figs. 2 and 3).

Drag folding occurs adjacent to the faults in the study area and is particularly well developed in the Alternating Limestone-Shale Member adjacent to Fault A on the east side of the Delta River.

Fault A, on the northern margin of the study area, was probably the principal controlling factor in the emplacement of the gabbro dike in the lower part of the section. Rowett (in press) believes that this fault continues southeastward and brings Permian and Tertiary sediments into fault contact in the vicinity of McCallum Creek (Text-fig. 2).

Fault E is well exposed near the confluence of Eureka Creek and the Delta River, where Tertiary and Paleozoic sediments are in fault contact. The continuation of this fault to the southeast is masked by younger sediments.

Fault C parallels Faults A and E, but apparently is of lesser displacement and extent. Drag folds adjacent to this fault indicate relative upward movement of the block to the south of this fault.

A small cross-fault (B) is of particular significance as it displaces the contact between the Lower Tuffaceous Sandstone Member and the Alternating Limestone-Shale Member along Rainy Creek. A second small cross-fault (D) occurs near the northwest end of Rainy Mountain, where it offsets limestones of the middle Limestone Member, as well as the sill at the crest of Rainy Mountain.

Structural Correlation and History

The southwest-dipping Permian section in the study area is believed to constitute the faulted south limb of a large anticline that is parallel to the general northwest trend of folds in this part of the Alaska Range. Similarly, Faults A, C, and E are part of the same fault system described by Bond (1965, p. 16-19) in the McCallum Creek-West Gulkana Glacier area and by Hanson (1963, p. 63-64) in the Rainbow Mountain area (Text-fig. 2).

According to Payne (1955), a period of deformation and intrusion occurred in middle to late Jurassic time in the Alaska Range. This was substantiated by Ragan and Hawkins (1966, p. 601-602) who obtained a potassium-argon date of 149 M.Y. from a biotite-bearing gneiss intruded by a quartz diorite body in the vicinity of Gulkana Glacier. The folding of these rocks as well as the upper Paleozoic sedimentary and volcanic strata therefore may be related to the Nevadan orogeny.

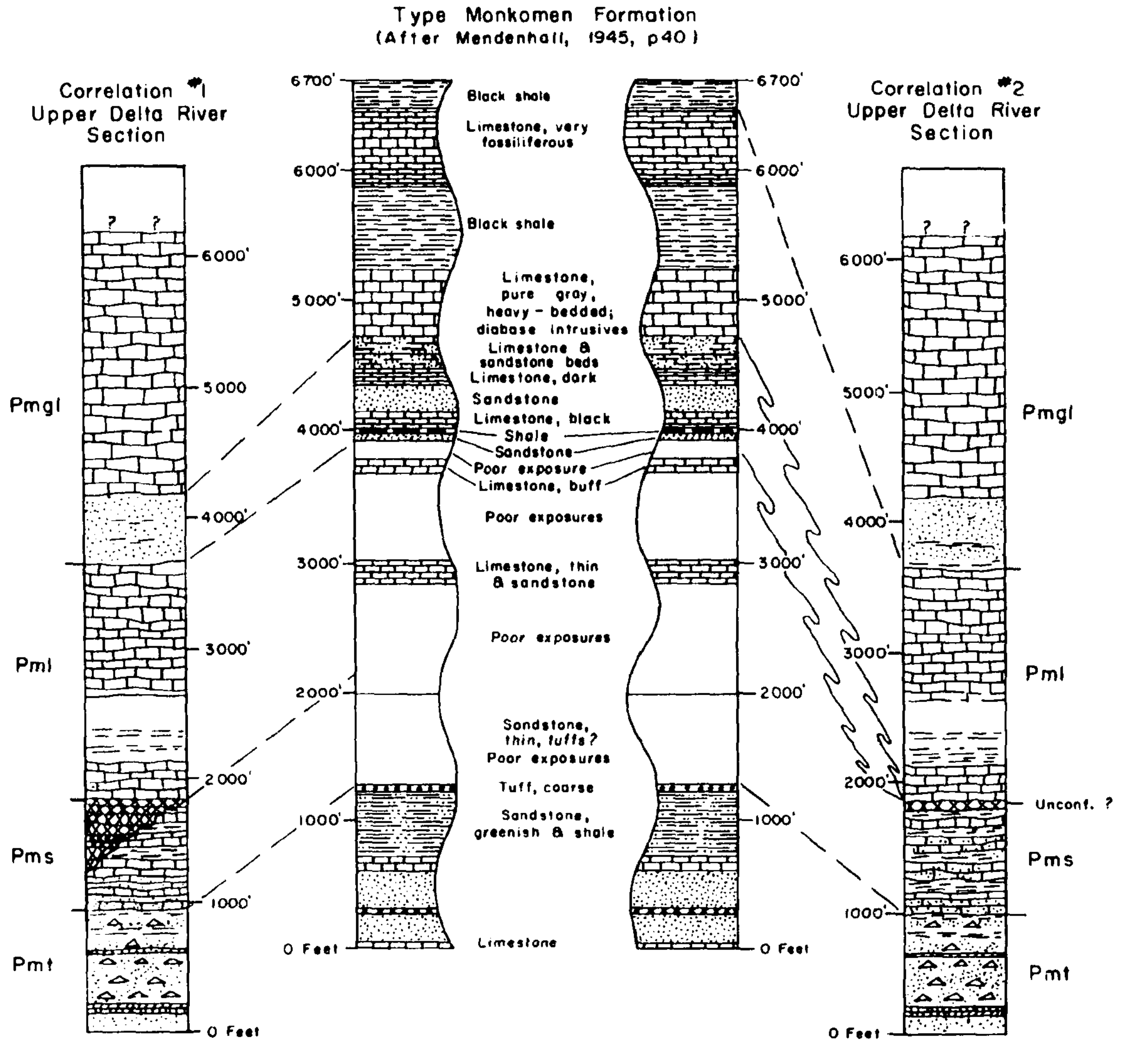
High angle faulting characterized late Cretaceous-Cenozoic movements in the Alaska Range (Payne, 1955; Eardley, 1962, p. 629-632). The transection of the folds as well as the Mesozoic (Jurassic ?) intrusives by two fault sets provides further evidence for late Cretaceous faulting. Reactivation of the block faults during the Tertiary (e.g. Fault E, Text-fig. 2) apparently was responsible for bringing Paleozoic and Tertiary rocks into fault contact near the mouth of Eureka Creek and elsewhere (see also Bond, 1965, p. 19).

Comparison with the Type Mankomen Formation

Previously I referred (1967, p. 1547) to the alternating limestones and shales (Pms) as unit 1, and the overlying limestones (Pml) as unit 2. Based on information from Rose (1965, p. 9-11), this part of the section was also tentatively correlated with some part of the upper Mankomen Formation at that time. These two units, as described above, are herein designated as members of the Mankomen Formation in the study area. Correlations of the Upper Delta River Permian section with the type Mankomen also is revised below.

Mendenhall (1905, p. 40-46) originally described the Mankomen Formation from the area north of Mankomen Valley, approximately 50 miles southeast of the study area. According to Mendenhall (*ibid.*, p. 41), the upper 4000 to 4500 feet of the Mankomen Formation is dominantly calcareous, while the lower 2000 feet is arenaceous and tuffaceous (Text-fig. 7). The same general lithic succession characterizes the rocks in the Upper Delta River area.

Megafossils (primarily brachiopods) identified from the Upper Delta River area correspond generically to many of those identified by Schuchert from Mendenhall's collection. Unfortunately the brachiopod faunas of this region have as yet been little studied and are not sufficiently diagnostic for detailed correlations. There is some evidence, however, that the section described in this report includes equivalents of most, if not all, of the type Mankomen Formation.



Text-fig. 7 - Tentative lithologic correlations of the Upper Delta River section with the type section of the Mankomen Formation.

The stratigraphic position of the lower Tuffaceous Sandstone Member is not readily apparent northward along the Delta River due to poor exposures. However, nearly 4000 feet of marine volcano-clastics, turbidites, and fossiliferous limestones exposed in the Rainbow Mountain area are believed by Rowett (in press) to be Tetelna equivalents. These are overlain by tuffaceous strata of unknown thickness. In the McCallum Creek area, several miles southeast of Rainbow Mountain, Mankomen equivalents are underlain by tuffs and tuffaceous sandstones at least 700 feet thick. This unit thus occupies a stratigraphic position between fossiliferous Mankomen and Tetelna equivalents. It is here regarded as a lithostratigraphic equivalent of the lower Mankomen Formation in its type area. As such, the overall lithic sequence in the areas described above are generally comparable to that of the type area of the Mankomen Formation.

Precise correlation of the Alternating Limestone-Shale Member with the type Mankomen is not possible inasmuch as the probable equivalent part of the type section is very poorly exposed (Mendenhall, 1905, p. 40-41). This member nevertheless tentatively can be correlated with the lower-middle type Mankomen on the basis of its comformable contact with the underlying tuffaceous member (Text-fig. 7).

Further attempts to accurately correlate the remaining (higher) portion of the Upper Delta River section with the type Mankomen necessarily are speculative, inasmuch as about 2800 feet of the middle part of the type Mankomen is covered. Two possible correlations are illustrated in Text-fig. 7. A careful biostratigraphic restudy of the type section obviously is needed to clarify the relationships of the study area to the type Mankomen Formation.

DISCUSSION OF FUSULINID ASSEMBLAGES

Because of the similarity of the Alaskan fusulinid fauna to that of the Ural region, I have adopted the terminology for the subdivision of the Lower Permian as used by Soviet colleagues for the western slope of the Urals (Likharev, 1966, Supplement Chart #8). I have divided the fusulinid fauna from the Upper Delta River section into six assemblage zones (Table 1, Text-figs. 5 and 6).

1) Assemblage Zone A: The oldest assemblage is characterized by the distribution of *Pseudofusulinella* *(Kanmeria)* sp. A through about 150 feet of the lower part of the Alternating Limestone-Shale Member. Only one sample within this interval, RC-6, was barren of fusulinids. *P.* *(K.)* sp. A is similar to several early Wolfcampian species of the Pacific northwest of North America and also to *P.* *(K.)* *[Fusulinella]* *usvae* (Dutkevich) from the Urals, U.S.S.R. (Dutkevich, 1939) and Spitsbergen (Forbes, 1960). An early to late Asselian age is indicated for this zone.

2) Assemblage Zone B: The lower boundary of Zone B is defined by the first appearance of the genus *Schwagerina* (*S.* *pseudokaragasensis* n. sp. and *S.* sp. A), while the top of this zone corresponds to the last occurrence of *Pseudofusulinella* cf. *P.* *(K.)* *parvula* Skinner and Wilde in the section. The limits of Zone B coincide with the range of *Schwagerina* sp.

A. Other species included in this zone are: P. (K.) valkenburghae n. sp., S. cf. S. emaciata, S. whartoni n. sp., S. callosa (Rauser-Chernousova), and P. (K.) sp. A. The last three species, however, are not confined to this zone.

The three species of Pseudofusulinella, herein included in the subgenus Kanmeria Ozawa, form two rather distinctive lineages (Ozawa, 1967, p. 162-164); P. (K.) sp. A and P. (K.) valkenburghae n. sp. are associated with the P. (K.) uthahensis group, while P. cf. P. (K.) parvula Skinner and Wilde belongs to the P. (K.) parvula lineage. The youngest known occurrence of related species in these groups is in middle Wolfcampian horizons of the McCloud Limestone in northern California. Pseudofusulinella ("Fusulinella" of Russian authors) is a comparatively uncommon element in the fusulinid faunas of the U.S.S.R. and thus far has been reported only in rocks of Asselian and early Sakmarian age. Most examples of Schwagerina in this zone show strong affinities for species that occur in the southern Urals and also in the Russian Platform of the U.S.S.R. S. pseudokaragasenis n. sp., S. whartoni n. sp., and S. callosa (Rauser-Chernousova) in particular are related closely to Russian forms. A compilation of the ranges of allied species in the U.S.S.R. supports a late Asselian-middle Sakmarian age for this zone (Likharev, 1966, text and supplement charts; Rauser-Chernousova, 1965, p. 9-28; Rauser-Chernousova, 1940, p. 41-45; Korzhenevsky, 1940, p. 1-5). However, S. callosa (Rauser-Chernousova), which occurs in the highest sample of Zone B, has previously been reported only from the Sterlitamak horizon in the U.S.S.R. Apparently this species also ranges lower in the Sakmarian in the Upper Delta River section.

3) Assemblage Zone C: This assemblage occurs in the upper part of the Alternating Limestone-Shale Member and is characterized by advanced species of the genus *Eoparafusulina*, including *E.* *(Eoparafusulina)* *mendenhalli* n. sp. and *E.* *(E.)* *waddelli* n. sp. Associated species are *Schwagerina* *rowetti* n. sp., *S.* *callosa* (Rauser-Chernousova) and *S.* *whartoni* n. sp. Both species of *Eoparafusulina* are advanced forms of the genus and some fusulinid taxonomists might be inclined to include these species, as presently defined, in the genus *Monodiexodina*. Early to middle Wolfcampian species from North America appear to be less highly evolved than *E.* *(E.)* *mendenhalli* n. sp. and *E.* *(E.)* *waddelli* n. sp. *E.* *(E.)* *alaskensis* (Dunbar) from Kuiu Island, Alaska, is probably most similar in evolutionary status.

The distribution of associated species of *Schwagerina* tends to support a younger age for this zone. *S.* *rowetti* n. sp., *S.* *callosa* (Rauser-Chernousova), and *S.* *whartoni* n. sp. are all closely allied to Schwagerinas from the Urals and Russian Platform. An analysis of the range of comparative forms from the U.S.S.R., together with the more advanced development of the two species of *Eoparafusulina* suggests a late-middle to (?) late Sakmarian age for this assemblage.

4) Assemblage Zone D: This zone includes the uppermost part of the

Alternating Limestone-Shale Member (Sample RC-20), and the lowest part of the conformably overlying Limestone Member. A distinctive group of Schwagerinas including S. moffiti n. sp., S. heineri n. sp., and S. sp. B are limited to this zone. One questionable specimen of Schubertella also occurs within this assemblage.

The developmental characteristics of S. moffiti n. sp. are very similar to S. hyperborea (Salter) from somewhat higher horizons in the Upper Delta River section and elsewhere in the Arctic, and also to S. juresanensis (Rauser-Chernousova) from Artinskian rocks in the southern Urals. S. heineri n. sp. and S. sp. B are apparently endemic to this region and do not closely resemble any described species known to the writer. The stratigraphic occurrence of the assemblage and affinities of S. moffiti n. sp. indicate a probable early Artinskian age.

5) Assemblage Zone E: The overlying zone is defined by the occurrence of a single undesignated species of Schwagerina, S. sp. C, which was found in the upper three samples of the lower part of the Limestone Member. The massive axial deposits and highly fluted septa are characteristic of late Wolfcamp-early Leonard species of the genus; however, S. sp. C does not closely resemble any other described forms. The age of this zone is considered to be early Artinskian.

6) Assemblage Zone F: Zone F comprises the youngest assemblage of fusulinids in the study section. It includes 450 feet of bioclastic limestones

in the Limestone Member, and its base occurs approximately 650 feet above Zone E. The assemblage is composed of a very distinctive group of highly evolved elongate Schwagerinas that possess many features of primitive forms of Parafusulina such as P. lutugini (Schellwien) and P. tschussovensis (Rauser-Chernousova) from lower and upper Artinskian deposits on the western slope of the Urals (Rauser-Chernousova, 1935, p. 142-147; Likharev, 1939, p. 40). Two new species, Schwagerina mankomenensis n. sp. and S. rainyensis n. sp., occur intermittently throughout Zone F with S. hyperborea (Salter). The latter species is also known from the upper part of the Belcher Channel Formation, Arctic Archipelago (Harker and Thorsteinsson, 1960) and from the Tahkandit Formation, northern Yukon Territory (Ross, 1967).

The upper beds of the Belcher Channel Formation were considered Leonardian in age by Harker and Thorsteinsson (1960, p. 13). Ross (1967) suggested that his Schwagerina jenkinsi assemblage from the Tahkandit Formation was older than middle or late Leonard. However, contrary to Ross' statement (ibid.), the species described by Korzhenevsky (1940) from the Sakmarian Limestones in the subsurface at Ishimbajevo, U.S.S.R., are in my opinion less highly evolved than S. hyperborea (Salter) or S. jenkinsi Thorsteinsson. The Russian forms, particularly S. sulcata (Korzhenevsky), S. rauserae (Korzhenevsky), S. ischimbajevi (Korzhenevsky), and S. moelleri (Schellwien), are closely related to S. whartoni n. sp. from much lower horizons (Zones B and C) in the Upper Delta River section.

On the other hand, S. hyperborea (Salter) has a much stronger affinity for S. juresanensis (Rauser-Chernousova) from Artinskian rocks in the southern Urals. It is also similar in construction to several Leonardian species of Schwagerina and Parafusulina. The age of Zone F is considered to be early to middle Artinskian, and equivalent to the Tazlarovsky horizon (zone of Parafusulina lutugini) of the Ural region.

BIOGEOGRAPHIC RELATIONS

The early Permian Fusulinidae from the Alaska Range are part of a distinctive boreal fauna that was relatively unrestricted in its dispersal throughout seas that occupied the Alaskan part of the Cordillean, the Franklinian and the Uralian geosynclines and marginal shelf areas. Species of Schwagerina from the Upper Delta River area are closely allied with those of the southern Urals. S. pseudokaragasensis n. sp., S. whartoni n. sp., and S. rowetti n. sp. from lower assemblages in the section show very strong affinities to Uralian Sakmarian species; S. callosa (Rauser-Chernousova) is in fact found in both areas. S. hyperborea (Salter) from the highest zone also occurs in Lower Permian deposits in the Yukon Territory and Arctic Archipelago, and is similar to the Artinskian species S. juresanensis (Rauser-Chernousova) from the Ural region. Most of the other described new species of Schwagerina apparently are endemic to Alaska and have not yet been reported from other areas. Several species have characteristics that suggest a common ancestry with more southerly North American species. However, the faunas of the midcontinent United States and Schwagerinas from the Tethyan realm are distinctly different from those of the Boreal realm.

A marine connection with the Western Cordillean province of Canada as far south as northern California is supported by the distribution of several groups of fusulinids. Ozawa (1967, p. 1962-164) has recently pointed out that species of the genus Pseudofusulinella (Kanmeria), particularly the P. (K.) uthanensis group, are widely distributed in the Pacific Northwest of North America, Spitsbergen, and the Ural Mountains. Forms belonging to this group are also found in the Canadian Arctic and are reported from the Alaska Range in this paper. The species of P. (K.) cf. P. parvula Skinner and Wilde described in this report also indicates a broader distribution for Ozawa's P. (K.) parvula group. It is interesting that the greatest diversity of species of P. (Kanmeria), including the most primitive forms thus far reported, occur in the northwestern part of the United States, notably in the McCloud Limestone of northern California. As Ozawa (1967, p. 164) suggests, the dispersal of this subgenus into the Boreal realm certainly must have originated from this center of diversity.

Species of the Eoparafusulina (Eoparafusulina) lineage as defined by Ross (1967) are also well documented in the Arctic, including Alaska, the Yukon Territory, Arctic Archipelago, and Greenland. The species from the upper Wordiekammen Limestones in Spitsbergen, which was questionably assigned to Parafusulina lutugini (Schellwien) by Forbes (1960), is probably a form of E. (Eoparafusulina). Additional species of the subgenus occur in northern California (McCloud Limestone) and have recently been described from the Neal Ranch Formation, Texas (Ross, 1967). Farther south, in the central Andes, Dunbar and Newell (1946) reported the occurrence of two elongate Schwagerinas, S. prolongata (Berry) and S. steinmanni Dunbar and Newell, which have cuniculi and heavy axial filling. These forms are certainly part of the E. (Eoparafusulina)-Monodiexodina lineage (Ross, 1962) and probably should be referred to the latter genus. It is not my purpose here to discuss the evolution of the E. (Eoparafusulina)-Monodiexodina complex, but the wide distribution of this lineage supports at least temporary connections of the Boreal, Cordillean, and Andean marine environments. As yet, species of E. (Eoparafusulina) or Monodiexodina have not been reported from the Western Cordillera in Canada, but dispersal certainly must have occurred through this region.

Few similarities exist between the Alaska Range fusulinids or any early Permian forms from the Boreal realm to fusulinids of the Japanese Islands. Ozawa (1967, p. 164) has suggested that the single species of Pseudofusulinella, P. (Kanmeria) japonica (Ozawa), from Lower Permian rocks at Mt. Raidenyama and the Mino Mountains was derived from the P. (K.) utahensis group, which dispersed northward from northwestern United States across the Boreal realm into the Uralian seaway and then eastward along the Tethyan realm to Japan. E. (Eoparafusulina) mendenhalli n. sp. described in this report from the Alaska Range, and E. (E.) alaskensis (Dunbar) from Kuiu Island, southeastern Alaska, are apparently related to E. (E.) langsonensis (Saurin), originally described from the Ky-Lua Limestone in Viet Nam, and more recently reported from the Sakamotozawa Series in Japan (Kanmera and Mikami, 1965, p. 288-289). This does not suggest an early Permian marine connection between Alaska and the Japanese Islands, however, as the faunas of the two areas are otherwise distinctive. The species from both geographic areas more likely were derived from boreal forms that may have had their origin from the Eoparafusulina stock that evolved in the middle Cordillean region, as suggested by Ross (1967c).

Dunbar (1932) described a species as Neoschwagerina columbiana (Dawson) from Marble Canyon, British Columbia, that subsequently has been reidentified as Yabeina columbiana by Thompson and Wheeler (1942). At that time Dunbar suggested a marine connection from the Orient around the northern Pacific to the Cordillean geosyncline as far south as California. Since then, Tethyan faunal elements have been well documented in British Columbia and the Pacific Northwest of the United States, including northern California (Anderson, 1941; Thompson, Wheeler and Danner, 1950; Thompson and Wheeler, 1942; Skinner and Wilde, 1966b, 1966c, 1966d; Douglas, 1967; and others). However, these faunas are not found in Alaska or other parts of the Arctic. Marine conditions apparently became much more restricted in the area of the ancestral Alaska Range later in the Artinskian, coincident with the beginning of epeirogenic uplift that culminated in Mesozoic time. Evidently, the Alaskan province, with its boreal faunas, was not directly connected with the "Pacific" (Japanese) Tethyan sea at any time during the Permian.

CORRELATION OF THE UPPER DELTA RIVER SECTION

In the following discussion I have limited my comments to several areas within the Boreal realm where fusulinids have been reported and formally described in the literature. My interpretation as to how the Alaskan section corresponds to the Russian divisions and subdivisions of the western Ural region of the U.S.S.R. is given in Text-figs. 5 and 6.

Kuiu Island, Alaska: A single fusulinid species, here identified as *Eoparafusulina (Eoparafusulina) alaskensis* (Dunbar) was described from the Lower Permian of Kuiu Island in southeast Alaska. Dunbar (1946) suggested that these forms came from the lower part of a 575 foot section measured by Wright and Wright (1908, p. 54-55) from Halleck Harbor near the north end of Saginaw Bay and were originally identified as "*Fusulina* aff. *F. longissima* Moeller". The *E. (E.) alaskensis* horizon is correlated with Zone C based on the close similarity of this species to *E. (E.) mendenhalli* n. sp.

Northeastern Alaska and Northwestern Yukon Territory: Fusulinids have been described from several localities in these areas by Skinner and Wilde (1966a) and Ross (1967b). There is some doubt as to the correct location of the samples examined by Skinner and Wilde, as the samples available to them were collected from float. *Eoparafusulina (Eoparafusulina) yukonensis* (Skinner and Wilde) and *E. (E.) laudoni* (Skinner and Wilde) were described from such (float) samples from the Tatonduk River area in the Yukon Territory, and the Nation River area in Alaska respectively. The latter species, considered the younger of the two by Skinner and Wilde (1966a), is thought by Laudon (Skinner and Wilde, ibid.) to have been derived from the Nation River Formation, while E. (E.) yukonensis is from the Permian Tahkandit Limestone. The horizons in which these species occur may also be approximate equivalents of Zone C. The species of Eoparafusulina from the Mankomen Formation in the study area are more highly evolved and probably are slightly younger. The E. yukonensis assemblage of Ross (1967) from Nelson's (1961) " Middle Recessive Unit" from the Yukon Territory likewise is correlated with Zone C.

A precise correlation with Ross' (1967) Schwagerina sp. B assemblage from the lower part of the Tahkandit Formation is more difficult. This assemblage is characterized by poorly preserved specimens of an undescribed species of Schwagerina that does not appear to be conspecific with any species from the study area. However, the heavy axial filling and highly fluted septa of this species is also characteristic of Schwagerina sp. C from Zone E. The Schwagerina jenkinsi assemblage of Ross (1967) from much higher horizons in the Tahkandit Limestone is correlative with Zone F.

Grinnell Peninsula, Arctic Archipelago: The fusulinid faunas described from unit 3 of the Belcher Channel Formation by Thorsteinsson (Harker and Thorsteinsson, 1960) are similar to many of the species from the Upper Delta River section. Their " faunule 1" , containing Pseudofusulinella utahensis Thompson and Bissel is considered equivalent to Zone B. Faunule 2, which is composed solely of Eoparafusulina (Eoparafusulina) paralinearis (Thorsteinsson) correlates with Zone C, while their youngest faunule (3) is equivalent to the highest Zone (F) described in this paper.

Northeast Greenland: Fusulinid faunas ranging in age from Moscovian to early Sakmarian have been described by Ross and Dunbar (1962) from Holm Land and Amdrup Land, northeast Greenland. Zonation of the section and a summary of the fauna is given by Dunbar and others (1962). Tentative correlation is possible with only part of the Greenland section, as most of the fusulinid-bearing horizons occur in older rocks. The lower part of the Upper Marine Group contains a Lower Permian fauna but unfortunately, these species do not occur in the Alaska Range section. Three incomplete specimens of Eoparafusulina (Eoparafusulina) cf. E. (E.) paralinearis (Thorsteinsson) were found in float thought to have been derived from the lower part of the Upper Marine Group. This part of the Greenland section (Zone of Pseudoschwagerina) may be equivalent to a portion of the Alternating Limestone-Shale Member of the Mankomen Formation up to and including Zone C. Dunbar and others (1962) suggested that the highest horizons (Profiles G and H) of the Upper Marine Group were older than the upper part of the Belcher Channel Formation, since the former lacks the highly evolved Schwagerinas that are characteristic of Harker and Thorsteinsson's "faunule 3". The same may apply to Zone F of the Upper Delta River section, but conclusive evidence is lacking as fusulinids were not reported from the uppermost 700 feet of the Upper Marine Group. Dunbar and others (1962) suggest a Sakmarian age for Profiles G and H on the basis of the brachiopod fauna. It is my opinion that Zone F of the Upper Delta River Mankomen Section and "faunule 3" of the Belcher Channel Formation are no older than early Artinskian.

Spitsbergen: Forbes (1960) described a Middle Carboniferous-Lower Permian fusulinid fauna from Spitsbergen and employed the geological and stratigraphical nomenclature of Gee, Harland and McWhae (1952), which has since been modified and revised twice by Forbes, Harland, and Hughes (1958), and Cutbill and Challinor (1965). I concur with Dunbar and others (1962) regarding the invalidity of some of Forbes' (1960) identifications. The upper Wordiekammen Limestones, which are equivalent to the upper part of the Tyrrellfjellet Member of the Nordenskioldbreen Formation (Cutbill and Challinor, 1965), nevertheless appear to be correlative with the lower part of the Limestone Member. The presence of Eoparafusulina in the highest horizons in the Wordiekammen Limestones suggest a correlation with Zone C of the Upper Delta River section. Ross' (1965) fauna from the upper part of the Cyathophyllum Limestone at Tempelfjorden (Collections F-4, F-5, and H-F [float]) also suggest a correlation with Zone C of the Delta River Mankomen section. However, I take exception to Ross' identification of Parafusulina furnishi. The primitive cuniculi of this species is not characteristic of this genus. Cutbill and Challinor (1965, p. 424) have indicated that Schwagerina anderssoni also shows some development of cuniculi and that " it does not seem possible to separate the two species" . The S. anderssoni zone was correlated with the Asselian and Lower Wolfcamp by these authors (Cutbill and Challinor, 1965), and later the same zone in the Tyrrellfjellet Member of the Nordenskioldbreen Formation on Ny Friesland likewise was correlated with the Asselian (Cutbill, 1968). However, Ross (1965) reported a number of species of Triticites that are conspecific with Carboniferous forms of the southern Urals, occurring with S. anderssoni. He therefore correlated this assemblage with the Upper Pennsylvanian (Virgil ?) of North America. Because of this dichotomy it is not feasible to attempt a correlation with the lower part of the Mankomen Formation. Moreover, if Cutbill and Challinor (1965) are correct, S. anderssoni may be the oldest species thus far reported with cuniculi.

PALEONTOLOGY

Methods

Forty-three rock samples of approximately seven pounds each were collected from measured sections in the Upper Delta River fault block (Text-figs. 4, 5, and 6). Sampled intervals are not regular inasmuch as rock specimens were collected for fusulinids whenever productive lithologies were encountered. Samples were not taken from the middle black shales of the Limestone Member.

Free fusulinid specimens were not observed in any part of the section. All collected rock material was cut into 1/8 inch slabs both parallel and perpendicular to bedding planes. Fusulinids were extracted from these and prepared for study.

Table 1 lists the distribution of fusulinid species according to sample number and position above the base of the measured section. The number of specimens sectioned per species also is noted. This number indicates in a general way the relative abundance of specimens per sample.

Faunal descriptions include measurements from morphological parameters as defined by Waddell (1966, p. 23-24). Measurements of chomata height were not recorded as these are secondary deposits and may not be entirely genetically controlled. In addition, van Ginkel (1965, p. 6) pointed out that the degree of coiling of the test (tightness of spire) can most usefully be expressed in quantitative terms. This parameter is computed by the formula:

$$\frac{RV_n + 1 - RV_n}{RV_n} \times 100, \text{ where } 1 \leq n \leq i, \text{ ie. } \frac{RV_2 - RV_1}{RV_1} \times 100;$$

$$\frac{RV_3 - RV_2}{RV_2} \times 100, \text{ etc.}$$

where RV = radius vector and the numerical subscript is equivalent to volution number.

Mean values (M) for quantitative data per number of data points (N) are included under species descriptions in the form M/N. Terminology referring to morphological features that were not quantified in this study also was adopted from Wadell (*ibid.*, p. 24-25, Text-figs. 7-10).

Statistics

In describing populations of fossil organisms, one of the primary objectives necessarily is an evaluation of both the nature and extent of variation. The inherent inadequacies of subjective discrimination of species are readily apparent to experienced investigators and are confusing to new students of systematics. One way of presenting a more meaningful classification as well as removing some of the subjectivity is to use a descriptive language which has a common denominator among all investigators. Data derived from measuring various morphological parameters of the Fusulinidae are amenable to both numerical analyses and statistical tests. Some of the advantages offered by this system are: results can be readily checked, confidence levels are stated, and degree of variability is shown. The nature and extent of variation in the characters under consideration are thereby precisely defined. It is perfectly true that a subjective element enters during the interpretation of these data; however, the criteria on which decisions were reached are given.

Two tables which summarize the variation for quantified morphological characters accompany most species descriptions. The first table indicates the per volution variation in half length (HL), radius vector (RV), protheca thickness (PT), tunnel width (TW), tightness of spire (TS), and form ratio (FR). Both the minimum and maximum diameter of the proloculus (Pro.) were similarly treated. Brief definitions of the statistical parameters are given below. The reader is also referred to Snedecor (1959), Miller and Kahn (1965), and Simpson, Roe and Lewontin (1960) for a more complete treatment of the statistics used in this report.

Number of Data Points (N): Number of measurements or computations.

Maximum (Max.): Highest value recorded per each variate.

Minimum (Min.): Lowest value recorded per each variate.

Arithmetic Mean ($\bar{X}$): Computed by $\sum X/N$ where $\sum X$ equals the sum of the data points for a variate.

Standard Deviation (s): Measure of the variance of a sample; given by:

$$s = \pm \sqrt{\frac{\sum (X)^2 - N\,(\bar{X})^2}{N - 1}} .$$

Coefficient of Variation (C.E.): Standard deviation expressed as a percentage of the mean, 100 X/$\bar{X}$.

Standard Error of the Mean ($S.E._{\bar{X}}$): A measure of the reliability of the sample mean as an estimate of the true mean of the sample population; given by: $s/\sqrt{N}$.

The second table summarizes the results of regression analyses which were calculated for each species, using the half length (HL), radius vector (RV), and protheca thickness (PT) as variables. Only two variables were used in each regression; HL : RV, and RV : PT. Because there is no compelling reason for considering either HL or RV (or RV or PT) as the dependent variable, regressions were calculated alternating the morphological parameters as independent and dependent variables. A linear correlation was found in each of these sets of variables, with the correlation coefficients generally exceeding 90 percent.

The slopes of the regression line were compared visually between closely related species. For a more precise method of comparison, see Miller and Kahn (1965, p. 204-210).

Used in conjunction with the statistics from the previously discussed table, these regression analyses were found to be useful both in describing and comparing morphological traits between species populations.

In addition, it was also possible to analyze individual variation in species groups for characters within the scope of the regression. Inasmuch as a regression function estimates the values of dependent variables, it is possible to record individual variation by computing a table of residuals, which are the differences between the actual value of the raw data and the estimated values of the same data points calculated by the regression. Because the raw data includes the parameters (RV : PT) or (HL : RV) for all the volutions of every member of the species, the computed residuals numerically reflect the variation within the spectrum of the sample population. Individual variation is thereby defined; however, specimens in which the residual value is greater than the standard error of estimate (p. 46) for most volutions probably do not belong in that species population (on the basis of these characters) and can be more closely scrutinized for anomalous variation in other characters, and perhaps be placed in another species population. On the other hand, a specimen which exceeds the values of the standard error of estimate in only one or two volutions may nevertheless belong to that species population. Used in conjunction with the per volution variation for these three parameters the chance for error is reduced considerably in the final analysis of these characters.

The tabulation of residuals for all the species comprising this fauna is quite extensive, and they consequently have not been included in this report. They are, however, available on request, as are all other tabulated raw measurements, from the Department of Geology, University of Alaska, for cost of zeroxing.

The following statistical notations are included in the tables for the regression analysis:

Number of Data Points (N_R): Number of dependent variables, or number of independent variables; these values are always equal.

Mean ($\bar{X}_R$): Arithmetic mean for dependent or independent variables denoted by subscript Y and X respectively.

Standard Deviation (s_R): Variance of dependent (subscript Y) or independent (subscript X) variables.

Correlation Coeficient (r): Measure of the degree of association between the dependent and independent variables (linear correlation coefficient); given by:

$$r = \sum XY \Big/ \sqrt{(\sum X^2)\ (\sum Y^2)}$$

Regression Coefficient (K): The slope or trend of the regression line; represents a change in Y per unit change in X in the equation: $Y = b + KX$. Given by: $K = s_Y/s_X$.

Standard Error of Regression Coefficient ($S.E._K$): (Standard error of the slope) A measure of the reliability of the slope of the regression line as an estimate of the true slope existing between the dependent and independent variables in the population. It is given by the formula:

$$S.E._K = (s_Y/s_X) \sqrt{\frac{1 - r^2}{N}}$$

Intercept (b): This is a constant in the equation: $Y = b + KX$ given by the intercept value where the regression line crosses the Y-axis (dependent variable axis).

Standard Error of Estimate ($S.E._{est.}$): A measure of the accuracy of the sampling plan, given by the formula:

$$S.E._{est.} = \sqrt{\frac{\sum(Y - Y_{est.})^2}{N}}$$

where Y equals a measured or calculated value of the dependent variable, and $Y_{est.}$ is equivalent to the value of Y estimated by the regression. The expression $\sum(Y - Y_{est.})^2$ therefore represents the unexplained variation or deviation from the regression. This is the variation due to sampling error.

Each selection in the tables represents a regression analysis; each analysis is noted in the form Y/X where Y equals the dependent and X the independent variable.

Repository

All specimens are housed in the paleontological collections of the Department of Geology, University of Alaska.

SYSTEMATIC PALEONTOLOGY

Superfamily _Fusulinacea_ von Möller, 1878

Family _Fusulinidae_ von Möller, 1878

Subfamily _Fusulininae_ von Möller, 1878

Genus _Pseudofusulinella_ Thompson, 1951

Subgenus _Kanmeria_ Ozawa, 1967

Pseudofusulinella sp. A

Plate 1, figs. 1-2

Table 2

Diagnosis

Shape: The test is fusiform to rhomboidal with bluntly pointed to broadly rounded poles. The lateral slopes are straight but may be slightly concave in the last two volutions. The outer volutions are usually much extended in comparison with the earlier ontogenetic stages. The axis of coiling is straight.

Size: Mature specimens are believed to possess 8 to 8.5 volutions and are about 5.6 mm in length and 2.6 mm in diameter. The outer volutions of the study specimens were badly abraided, making accurate measurements impossible.

Half Length: The mean half lengths for two specimens for the first through the eighth volutions are: .15, .27, .42, .73, 1.10, 1,35, 2.57, and 3.25 mm.

Radius Vector: The mean radius vectors for volutions one through eight are: .10, .15, .22, .32, .44, .64, .90, and 1.8 mm respectively.

Wall: The spirotheca is composed of tectum and a lower fibrous layer. In the outer volutions, the fibrous layer is particularly well developed. The darker areas separating the mural pores appear as "false alveoli". Epithecal deposits are thick in the inner volutions and occur irregularly in other parts of the test. The protheca is of an even consistency and increases in the first four volutions, after which it maintains approximately the same thickness until the last volution, where it again becomes thicker. The average protheca thickness for volutions one through eight are: 11.5, 16.2, 16.5, 25.6, 34.6, 31.9, 33.9, and 50.1 microns.

Chomata: Chomata are well developed on all volutions and are high and narrow. The chomata on the inner volutions are continuous with the heavy epithecal deposits but are more distinctive in later ontogenetic stages. Heavy secondary deposits arch over the tunnel from the chomata in most volutions. Additional secondary deposits arch over the tunnel from the chomata in most volutions. Additional secondary deposits occur adjacent to the chomata in the outer three volutions.

Axial Deposits: Secondary axial filling is absent except for discontinuour patches at the poles of the second through fourth volutions.

Tunnel: The tunnel is narrow and well defined, and follows an irregular path. The tunnel height is low, probably never greater than half that of the chambers. Average tunnel widths for volutions one through eight are: .03, .04, .06, .11, .14, .19, .31, and .54 mm.

Septa: The septa are very weakly fluted on the lateral slopes of the outer volutions but are strongly folded at the poles in all volutions. Mean values of septai counts for volutions one through five are: 8.2/6, 13.8/6, 16.8/5, 19.4/5, and 20.8/5 respectively.

Form Ratio: The average form ratios for the two specimens for volutions one through eight are: 1.56, 1.92, 1.96, 2.30, 2.51, 2.10, 2.86, and 2.80.

Tightness of Spire: The shell is tightly coiled in the juvenarium. The percent expansion of succeeding volutions gradually decreases outward from the initial chamber with an average for two specimens of: 52.6, 50.2, 45.2, 40.5, 45.4, 39.9, and 30.5 percent.

Proloculus: The proloculus is small and round with an average maximum and minimum outside diameters of 129.8 and 116.4 microns.

Discussion

Pseudofusulinella sp. A is generally similar to P. antiqua Skinner and Wilde and P. fusiformis Skinner and Wilde from the lower part of the McCloud Limestone, northern California, but differs in size, is not inflated at the midplane, and has nearly straight lateral slopes. There are also some characters common to P. sp. A and P. uthanensis Thompson and Bissel from the Oquirrh Formation, Utah (Thompson, 1954, p. 34) and from the Sublett Range, Idaho (Thompson and others, 1958). The former is larger and more elongate with essentially straight lateral slopes, and has a thicker protheca. The range of variation that has been attributed to this species (cf. Harker and Thorsteinsson, 1960, p. 23-24, and Cassity and Langenheim, 1966, p. 945-946) make further comparisons with P. utahensis difficult.

Occurrence and Material

Pseudofusulinella sp. A occurs in Zones A and B in the Alternating Limestone-Shale Member in samples RC-1, RC-2, RC-3, RC-4, RC-5, RC-7, RC-9, and RC-10. It is associated with Schwagerina pseudo-karakasensis and S. sp. A in sample RC-9, and with S. cf. S. emaciata in sample RC-10.

Table 2. Regression Analysis for *Pseudofusulinella* sp. A

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	14	14	14	14
$\bar{X}_{RX}$	1.100	.447	.447	25.479
$\bar{X}_{RY}$	.447	1.100	25.479	.447
s_{RX}	1.029	.352	.352	11.734
s_{RY}	.352	1.029	11.734	.352
r	.988	.988	.891	.891
K	.337	2.891	29.748	.027
$S.E._K$	.016	.133	4.370	.004
b	.076	- .193	12.177	- .233
$S.E._{est.}$	.058	.169	5.539	.166

The description is based on two axial, six sagittal, and five oblique sections.

Catalogue Numbers

UA2000 through UA2012.

Pseudofusulinella valkenburghae Petocz, n. sp.

Plate 1, figs. 3-11

Tables 3 and 4

Diagnosis

Shape: The shell is elongate fusiform to fusiform, with broadly rounded to bluntly pointed poles. Inner volutions tend to be somewhat oviodal with straight to concave lateral slopes. The axis of coiling is straight to gently arched.

Size: Mature individuals of 6 to 7.5 volutions range in length from 3.1 to 6.1 mm and 1.5 to 1.9 mm in width. These estimates are based largely on interpretation of eroded specimens.

Half Length: Mean half lengths for volutions 1 through 7.5 are: .12/9, .27/9, .47/9, .80/9, 1.21/9, 1.77/8, 2.47/4, and 2.59/2 mm respectively.

Radius Vector: Mean values for radius vector for the first through seventh volutions are: .10/9, .15/9, .24/9, .34/9, .47/9, .66/9, and .83/4 mm.

Wall: The spirotheca is composed of tectum and diaphanotheca with mural poles in the outer volutions of several individuals. Epithecal deposits are irregular but generally heaviest in the inner volutions. Few specimens were entirely free of these deposits. The protheca is thin and of even consistency. Mean values for protheca thickness for volutions one through seven are: 10.7/9, 15.8/9, 18.4/9, 21.8/9, 24.7/9, 28.1/7, and 24.3/2 microns.

Chomata: Chomata are strongly developed in all volutions and normally are about one-half the chamber height. The shape of the chomata is asymmetrical to rounded. Secondary deposits may arch over the tunnel path between chomata.

Axial Deposits: Axial filling is lacking except for small, irregular local patches at the junction of volutions.

Tunnel: The tunnel is narrow and follows an irregular path. Its height is low but increases up to half that of the chambers in outer volutions.

Mean values for tunnel width are: .03/7, .05/9, .08/9, .11/9, .17/9, .27/8, and .37/6 mm for the proloculus through the sixth volution.

Septa: The septa are fluted in the polar region. Very weak folding occurs along the lateral slopes of the outer volutions. Mean values for septal counts for the first through sixth volutions are: 8.4/5, 12.4/5, 17/4, 16.8/4, 15/4, and 18/3.

Form Ratio: Mean values of form ratio for volutions one through seven are: 1.31/9, 1.76/9, 2.01/9, 2.38/9, 2.57/9, 2.70/8, and 2.90/3 respectively.

Tightness of Spire: The test is loosely coiled but the percent increase of succeeding volutions decreases outward from the initial chamber with mean values of 62.3/9, 52.7/9, 42.7/9, 40.2/9, 41.2/9, and 33.4/4.

Proloculus: The proloculus is of varying size, ranging from 86.4 to 155.1 microns for the maximum outside diameter. Mean values for the maximum and minimum outside diameter are 122.4/9 and 108.9/9 microns respectively.

Discussion

Pseudofusulinella valkenburghae n. sp. and *P.* sp. A agree closely in most measured parameters. *P. valkenburghae* differs in its more pronounced concave lateral slopes, less massive chomata, fewer volutions, and more loosely and evenly coiled spire. *P. valkenburghae* is similar in shell construction to *P. antiqua* Skinner and Wilde, *P. fusiformis* Skinner and Wilde, and *P. uthensis* Thompson and Bissel, but there are several differences which distinguish it from these species.

The species is named for Judith Van Valkenburgh, University of Alaska.

Occurrence and Material

Pseudofusulinella valkenburghae n. sp. is found only in sample RC-11 in Zone B of the Alternating Limestone-Shale Member. It occurs in association with *Schwagerina whartoni* n. sp. and *S.* cf. *S. emaciata*.

The description is based on nine axial, five sagittal and two oblique sections.

Catalogue Numbers

Holotype: UA2014; paratypes UA2013, and UA2015 through UA2028.

Table 3. Regression Analysis for Pseudofusulinella valkenburghae

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	54	54	54	54
$\bar{X}_{RX}$	.798	.337	.337	20.013
$\bar{X}_{RY}$	.337	.798	20.013	.337
s_{RX}	.659	.230	.230	7.984
s_{RY}	.230	.659	7.984	.230
r	.961	.961	.781	.781
K	.335	2.756	27.146	.023
$S.E._K$	.013	.110	3.012	.003
b	.070	- .131	10.861	- .112
$S.E._{est.}$	.064	.184	5.036	.145

Volution	HL 1	2	3	4	5	6	7	8
N	9	9	9	9	9	8	4	2
Max. Value	.157	.367	.722	1.194	1.706	2.148	3.060	3.060
Min. Value	.095	.223	.351	.505	.894	1.410	1.863	2.411
$\overline{X}$	.124	.272	.474	.796	1.206	1.768	2.474	2.594
S	.019	.046	.109	.199	.268	.293	.505	.260
C.V.	15.6	17.1	23.0	25.0	22.2	16.6	20.4	10.0
S.E.$_{\overline{X}}$	.006	.015	.036	.066	.089	.103	.252	.184

Volution	RV 1	2	3	4	5	6	7	8
N	9	9	9	9	9	9	4	1
Max. Value	.117	.183	.264	.379	.521	.744	.884	1.163
Min. Value	.084	.131	.208	.284	.403	.554	.727	1.163
$\overline{X}$	.095	.154	.235	.336	.471	.664	.827	-
S	.012	.017	.019	.031	.048	.066	.071	-
C.V.	13.0	10.8	8.2	9.3	10.3	9.9	8.6	10.0
S.E.$_{\overline{X}}$	.004	.006	.006	.010	.016	.022	.035	.184

Volution	Pro.Min.	Pro.Max.
N	9	9
Max. Value	140.3	155.1
Min. Value	73.7	86.4
$\overline{X}$	108.9	122.4
S	20.4	25.0
C.V.	18.8	20.4
S.E.$_{\overline{X}}$	6.8	8.3

Table 4, Part 1. Observed Variation in <u>Pseudofusulinella</u> <u>valkenburghae</u>

Volution	FR 1	2	3	4	5	6	7	8
N	9	9	9	9	9	8	3	1
Max. Value	1.57	2.20	3.02	3.96	3.77	3.54	3.52	2.39
Min. Value	1.09	1.38	1.55	1.78	2.05	2.18	2.56	2.39
$\overline{X}$	1.31	1.76	2.01	2.38	2.57	2.70	2.91	-
S	.19	.27	.43	.66	.60	.43	.53	-
C.V.	14.4	15.4	21.2	27.6	23.2	15.9	18.3	-
S.E.$_{\overline{X}}$	.06	.09	.14	.22	.20	.15	.31	-

Volution	PT	1	2	3	4	5	6	7	8
N		9	9	9	9	9	7	2	1
Max. Value		12.1	21.5	26.4	28.6	38.5	46.2	29.2	42.9
Min. Value		8.8	12.1	12.1	12.7	17.6	18.2	19.3	42.9
$\bar{X}$		10.7	15.8	18.4	21.8	24.7	28.1	24.3	-
S		1.2	3.5	4.4	4.2	6.3	9.1	7.0	-
C.V.		11.4	22.0	23.7	19.1	25.3	32.6	28.9	-
S.E.$_{\bar{X}}$		.4	1.2	1.5	1.4	2.1	3.5	5.0	-

Volution	TW	0	1	2	3	4	5	6	7
N		7	9	9	9	9	8	6	1
Max. Value		.040	.066	.101	.153	.224	.352	.464	.374
Min. Value		.024	.045	.054	.084	.115	.182	.301	.374
$\bar{X}$		.034	.054	.076	.109	.168	.271	.368	-
S		.006	.007	.014	.020	.038	.065	.064	-
C.V.		18.5	13.0	18.7	18.6	22.8	24.0	17.5	-
S.E.$_{\bar{X}}$		.002	.002	.005	.007	.013	.023	.026	-

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7	7-8
N		9	9	9	9	9	4	1
Max. Value		93.1	71.4	51.8	51.4	46.0	40.8	31.6
Min. Value		52.8	36.3	36.2	32.4	34.1	24.5	31.6
$\bar{X}$		62.3	52.7	42.7	40.2	41.2	33.4	-
S		13.5	10.5	5.0	5.6	4.0	7.1	-
C.V.		21.7	19.9	11.7	13.9	9.7	21.2	-
S.E.$_{\bar{X}}$		4.5	3.5	1.7	1.9	1.3	3.5	-

Table 4, Part 2. Observed Variation in *Pseudofusulinella valkenburghae*

Pseudofusulinella cf. P. parvula Skinner and Wilde

Plate 1, figs. 12-18

Table 5

Diagnosis

Shape: The shell is small, fusiform with bluntly pointed poles. The axis of coiling is straight.

Size: Individuals of 4 to 5.5 volutions range in length from 1.3 to 1.8 mm and .6 to 1.0 mm in width.

Half Length: The mean half lengths for the first four volutions are: .12/3, .27/3, .54/3, and .83/3 mm.

Radius Vector: The average radius vectors for three specimens for volutions one through five are: .08, .13, .21, .29, and .42 mm respectively.

Wall: The spirotheca is composed of tectum and diaphanotheca and is of even consistency. Heavy epithecal deposits are found above the tectum in all volutions but are more dense in the earlier ontogenetic stages. The mean protheca thicknesses for the first through fifth volutions are: 9.9/3, 14.5/3, 22.2/3, 27.8/2, and 33.0/3 microns.

Chomata: Chomata are developed on all volutions including the proloculus, and are asymmetrical to rounded. The chomata on the inner volutions are continuous with thick epithecal deposits on the tectum. They vary in height from one-half to three-fourths that of the chambers. Secondary deposits that arch over the tunnel between chomata were observed but are uncommon.

Axial Deposits: Not present.

Tunnel: The tunnel is wide in comparison with the size of the test, and follows a straight to slightly irregular path. In one slightly oblique sagittal section, the tunnel height appeared low, less than half that of the chambers. Mean tunnel widths for the proloculus through the fifth volution are: .03/2, .04/3, .06/3, .10/3, .16/3, and .20/2 mm.

Septa: The septa are essentially planar throughout the shell with only a trace of folding at the poles. Septal counts for one specimen for the first three volutions are: 12, 16, and 17 successively.

Form Ratio: The form ratios are small, with mean values for three specimens of: 1.22, 1.66, 1.90, 1.87, and 1.81 for volutions one through five respectively.

Tightness of Spire: The test is evenly and comparatively tightly coiled. The percent increase of successive volutions decreases continuously from the first volution, with mean values of: 76.3, 55.6, 43.9, and 44.0 percent.

Proloculus: The initial chamber is small with mean values for the maximum and minimum outside diameters of 93.3 and 90.0 microns.

Discussion

Pseudofusulinella cf. P. parvula Skinner and Wilde from the Alaska Range differs in several respects from the middle Wolfcampian species from the McCloud Limestone in northern California (Skinner and Wilde, 1965, p. 33). P. parvula Skinner and Wilde is slightly larger and has 1.5 more volutions in the adult shell. The wall is apparently thicker in the fifth volutions.

The Alaskan species is one of the smallest species of Pseudofusulinella known, and aside from the above, does not resemble any other described species. The slight variations and small sample of this species leaves some doubt as to its proper designation.

Occurrence and Material

Pseudofusulinella cf. P. parvula Skinner and Wilde was found only in sample RC-13 in Zone B of the Alternating Limestone-Shale Member. Its association in this sample with the first appearance of Schwagerina callosa (Rauser-Chernousova) suggests a middle to late Sakmarian age.

The description is based on one sagittal and three axial sections.

Table 5. Regression Analysis for Pseudofusulinella cf. P. parvula

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	12	12	12	12
$\bar{X}_{RX}$	.397	.192	.192	18.583
$\bar{X}_{RY}$	.192	.397	18.583	.192
s_{RX}	.247	.116	.116	8.734
s_{RY}	.116	.247	8.734	.116
r	.806	.806	.852	.852
K	.377	1.726	64.424	.011
$S.E._K$	.087	.400	12.526	.002
b	.042	.067	6.241	- .018
$S.E._{est.}$	.072	.153	4.798	.063

Catalogue Numbers

UA2029 through UA2032.

Subfamily *Schwagerininae* Dunbar and Henbest, 1930

Genus *Schwagerina* von Möller, 1877

Schwagerina cf. *S. emaciata* (Beede),

Plate 2, figs. 6-18

Tables 6 and 7

Cf. *Schwagerina emaciata* (Beede), Forbes and McGugan, 1959, p. 40-43, Plate 1, figs. 1-7.

Cf. *Schwagerina* cf. *S. emaciata* (Beede), Forbes, 1960, p. 219, Plate 33, figs. 12-15.

Diagnosis

Shape: The test is fusiform with bluntly rounded to bluntly pointed poles. The axis of coiling is straight.

Size: This species is a small representative of the genus and mature individuals range in length from 2.6 to 4.3 mm, and from 1.3 to 1.6 mm in width.

Number of Volutions: Specimens which are considered mature have 4.5 to 5.5 volutions.

Half Length: The mean half lengths for volutions one through five are: .14/14, .34/14, .66/14, 1.10/11, and 1.60/5 mm.

Radius Vector: Mean values for radius vector are: .11/4, .18/14, .28/14, .44/12, and .60/5 mm for volutions one through five respectively.

Wall: The spirotheca is composed of tectum and keriotheca of moderate texture. Alveoli are not apparent in the protheca until volution two or three. Epithecal deposits occur irregularly, but are heaviest on the tectum of inner volutions. The average thickness of the protheca in volutions one through five is: 13.2/14, 19.6/14, 26.7/14, 39.5/10, and 66.6/4 microns.

Chomata: Small chomata are common on the proloculus and first volution. Pseudochomata are present on the succeeding 1.5 volutions. Secondary deposits apparently originating in the vicinity of the pseudochomata may arch over the tunnel but this characteristic is not always present.

Axial Deposits: Light axial filling is restricted to the first two or three chambers in most specimens. Small localized heavier deposits may occur in the polar region where opposing volutions meet.

Tunnel: The tunnel is narrow and has an irregular path. It is well defined only when bordered by chomata or pseudochomata in the juvenarium. Tunnel height is very low, less than half that of the chambers. Mean values for tunnel width for the proloculus through the fourth volution are: .04/13, .06/13, .10/12, .15/9, and .24/4 mm.

Septa: The septa are thick and strongly, but irregularly, fluted from pole to pole. Some of the higher arches commonly are in contact with the base of succeeding volutions. Arches are generally rounded with semi-parallel sides. Secondary deposits are commonly found as infillings of septal loops, particularly in the early volutions. The average septal count in the first volution of two specimens is eight. Volutions two through four in one individual contain 15, 16, and 21 septa respectively.

Form Ratio: Mean values for form ratio for the first through fifth volutions are: 1.27/14, 1.89/14, 2.32/14, 2.58/11, and 2.68/5 mm respectively.

Tightness of Spire: The test is rather loosely coiled and expansion is regular. The mean percent increase of volutions one through four is: 63.5/14, 58.5/14, 54.2/12, and 64.5/5.

Proloculus: The proloculus is of medium size but is a variable character in this species. Mean values for the maximum and minimum outside diameter are 135.0/14 and 118.2/14 microns.

Discussion

Schwagerina cf. *S. emaciata* compares closely to *S.* sp. A in growth rate and some other parameters but is distinguished from that species by its fewer number of volutions, significantly smaller diameter of the outer volutions, and its thinner protheca in the outer volutions. Unfortunately, sagittal sections were not available for comparison of septal counts. Similarity in growth is also indicated between *S.* cf. *S. emaciata* and *S. pseudokaragasensis* n. sp. and *S. rowetti* n. sp. by regression analysis for the variable RV and HL (Tables 6, 8, and 12). *S.* cf. *S. emaciata* differs from the former species in having fewer volutions, more irregular fluting, and larger values for form ratio in the outer volutions. *S. rowetti* is larger than this species, has a thicker protheca in the outer volutions, and has a different style of septal fluting.

This species agrees in general with some of the many descriptions of *S. emaciata* (Beede) but differs from most of these in having fewer volutions, shorter length, and a greater mean protheca thickness in the last (fifth) volution. Due to the great variety of forms described as *S. emaciata* (Beede) and its apparent widespread distribution, there is some doubt as to the exact designation of the present species. It is probably most closely related to the forms described by Forbes and McGugan (1959) from Wapiti Lake in British Columbia, and by Forbes (1960) from the Lower

Table 6. Regression Analysis for <u>Schwagerina</u> cf. <u>S. emaciata</u> (Beede)

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	55	55	55	55
$\bar{X}_{RX}$	.582	.259	.259	26.418
$\bar{X}_{RY}$	.259	.582	26.418	.259
s_{RX}	.469	.175	.175	16.623
s_{RY}	.175	.469	16.623	.175
r	.956	.956	.902	.902
K	.357	2.561	85.696	.010
$S.E._K$	.015	.108	5.650	.001
b	.051	- .081	4.229	.008
$S.E._{est.}$	.052	.139	7.260	.076

Volution	HL 1	2	3	4	5	6
N	14	14	14	11	5	1
Max. Value	.276	.718	1.217	1.896	1.945	2.125
Min. Value	.092	.213	.390	.705	1.328	2.125
$\bar{X}$	.138	.342	.656	1.095	1.604	-
S	.052	.143	.228	.337	.304	-
C.V.	37.7	41.8	34.8	30.8	18.9	-
S.E.$_{\bar{X}}$	.014	.038	.061	.102	.136	-

Volution	RV 1	2	3	4	5
N	14	14	14	12	5
Max. Value	.174	.334	.573	.979	.698
Min. Value	.074	.127	.193	.309	.525
$\bar{X}$	.107	.176	.282	.435	.600
S	.025	.052	.097	.180	.064
C.V.	23.7	29.4	34.2	41.3	10.7
S.E.$_{\bar{X}}$	.007	.014	.026	.052	.029

Volution	Pro. Min.	Pro. Max.
N	14	14
Max. Value	160.6	181.0
Min. Value	83.1	97.4
$\bar{X}$	118.2	135.0
S	22.9	26.8
C.V.	19.3	19.8
S.E.$_{\bar{X}}$	6.1	7.2

Table 7, Part 1. Observed Variation in _Schwagerina_ cf. _S. emaciata_

Volution	FR 1	2	3	4	5
N	14	14	14	11	5
Max. Value	1.59	2.43	2.68	2.87	3.37
Min. Value	.92	1.39	1.71	1.94	2.24
$\bar{X}$	1.27	1.90	2.32	2.58	2.68
S	.22	.30	.32	.31	.47
C.V.	17.3	16.0	13.6	12.2	17.5
S.E.$_{\bar{X}}$	.06	.08	.08	.10	.21

Volution	PT	1	2	3	4	5
N.		14	14	14	10	4
Max. Value		20.4	36.9	51.2	64.9	83.6
Min. Value		8.3	10.5	17.6	27.5	50.6
$\bar{X}$		13.2	19.8	26.7	39.5	66.6
S		3.5	6.4	9.3	11.3	18.1
C.V.		26.6	32.1	34.8	28.6	27.2
S.E.$_{\bar{X}}$		.9	1.7	2.5	3.6	9.1

Volution	TW	0	1	2	3	4	5
N		13	13	12	9	4	1
Max. Value		.062	.111	.228	.207	.304	.423
Min. Value		.020	.041	.059	.103	.190	.423
$\bar{X}$		.038	.058	.096	.149	.235	-
S		.012	.018	.044	.029	.052	-
C.V.		31.2	31.5	45.7	19.8	22.3	-
S.E.$_{\bar{X}}$		.003	.005	.013	.010	.026	-

Volution	TS	1-2	2-3	3-4	4-5
N		14	14	12	5
Max. Value		92.0	71.6	70.7	70.6
Min. Value		41.7	47.5	42.5	52.0
$\bar{X}$		63.5	58.5	54.2	64.5
S		11.4	8.1	7.0	7.5
C.V.		18.0	13.8	12.9	11.7
S.E.$_{\bar{X}}$		3.1	2.2	2.0	3.4

Table 7, Part 2. Observed Variation in _Schwagerina_ cf. _S. emaciata_

Permian of Spitsbergen.

Occurrence and Material

Schwagerina cf. *S. emaciata* occurs in samples RC-10 and RC-11 from Zone B of the Alternating Limestone-Shale Member. Similar forms occur in Lower Permian rocks in British Columbia and Spitsbergen.

The description is based on twelve axial, one oblique, and two sagittal sections.

Catalogue Numbers

UA2033 through UA2049.

Schwagerina pseudokaragasensis Petocz, n. sp.

Plate 1, figs. 19-26

Tables 8 and 9

Diagnosis

Shape: The test is fusiform with broadly rounded to bluntly pointed poles.

The axis of coiling is straight. The first volution is low and subglobose. Succeeding volutions are fusiform but the overall shape of the entire test is determined early in the ontogeny.

Size: Mature individuals of 7 to 7.5 volutions range in length from 4.8 to 7 mm, and in width from 2.4 to 2.7 mm.

Number of Volutions: Only two of eight specimens possess less than seven volutions; these have five and six volutions.

Half Length: The mean values for the first through seventh volutions are: .18/8, .37/8, .58/8, .92/8, 1.56/8, 2.37/8, and 3.22/6 mm.

Radius Vector: The means of the radius vectors for volutions one through seven are: .12/8, .18/8, .28/8, .42/8, .63/8, .92/7, and 1.34/4 mm.

Wall: The spirotheca is composed of a thin tectum and moderately coarse keriotheca. The protheca is thin in the juvenarium and the wall texture usually cannot be seen in the first 1 to 1.5 volutions. Epithecal deposits are irregularly present on the early volutions. The mean values for protheca thickness for the first through seventh volutions are: 12.8/8, 18.1/8, 26.2/8, 44.0/7, 58.9/8, 73.5/7, and 88.2/3 microns.

Chomata: Chomata are present on the proloculus and the first 1 to 1.5 volutions. Pseudochomata are irregularly present on the succeeding two volutions. Secondary deposits which apparently are associated with these structures commonly occur in an arch above the tunnel in the first three volutions.

Axial Deposits: Light secondary deposits occur within the juvenarium. Local heavy patches of axial filling occur along the axis of coiling in the polar area of volutions.

Tunnel: The tunnel is narrow and low, generally less than half the chamber height. The tunnel path is slightly irregular and well defined only in the early volutions which possess pseudochomata. Mean values of tunnel width from the proloculus through the fifth volution inclusive are: .04/8, .06/8, .09/7, .14/7, .23/5, and .44/2 mm.

Septa: The septa are regularly and intensely fluted from pole to pole. The fluting is high and commonly occupies the tunnel path in the outer volutions. Mean septal counts from the first through the sixth volutions are: 9.0/3, 14.3/3, 17.3/3, 19.0/3, 20.0/2, and 25.0/1.

Form Ratio: The calculated means for form ratio from the first through the seventh volutions are: 1.51/8, 1.98/8, 2.11/8, 2.21/8, 2.49/8, 2.58/7, and 2.45/4 respectively.

Tightness of Spire: The test is evenly coiled and expands regularly in most specimens. The mean values for percentage increase of each volution are: 55.7/8, 49.3/8, 51.6/8, 50.8/8, 51.1/7, and 52.7/4.

Proloculus: The proloculus is small with an average maximum and minimum outside diameter of 146.3/7 and 133.6/7 microns respectively.

Discussion

The similarities in growth between Schwagerina pseudokaragasensis n. sp., S. cf. S. emaciata, S. rowetti n. sp., and S. sp. A have been previously considered in the discussion under S. cf. S. emaciata. S. pseudokaragasensis is smaller, has a thinner protheca in the outer volutions, and a different style of septal fluting than S. rowetti. S. sp. A is longer and has a thinner protheca in the outer volutions.

S. pseudokaragasensis is very similar to S. karagasensis (Rauser-Chernousova) from the Upper Sakmarian of the southern Urals in the U.S.S.R. (Rauser-Chernousova, 1940, 1965). The two species compare closely in most measured parameters but S. karagasensis differs in its thicker protheca in the first four volutions, larger diameters of the inner volutions, and general absence of axial deposits. Septal counts were omitted in the descriptions of S. karagasensis. S. pseudokaragasensis is also similar to some forms of S. plicatissima (Rauser-Chernousova) and S. verneuili (Moller), also from the Sakmarian of the southern Urals, in shape of the test and style of septal fluting.

Occurrence and Materials

Schwagerina pseudokaragasensis n. sp. occurs in samples RC-8

Table 8. Regression Analysis for *Schwagerina pseudokaragasensis*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	48	48	48	48
$\bar{X}_{RX}$	1.079	.458	.458	40.058
$\bar{X}_{RY}$	.458	1.079	40.058	.458
s_{RX}	.935	.350	.350	25.537
s_{RY}	.350	.935	25.537	.350
r	.983	.983	.909	.909
K	.368	2.628	66.363	.013
$S.E._K$	.010	.073	4.483	.001
b	.061	- .123	9.693	- .041
$S.E._{est.}$	.066	.175	10.751	.147

Volution	HL 1	2	3	4	5	6	7	8
N	8	8	8	8	8	8	6	1
Max. Value	.279	.613	.853	1.342	2.266	2.706	3.716	3.496
Min. Value	.138	.269	.443	.705	1.115	1.781	2.411	3.496
$\overline{X}$	.178	.367	.581	.921	1.557	2.373	3.222	-
S	.050	.116	.161	.222	.372	.378	.525	-
C.V.	27.9	31.6	27.7	24.0	23.9	15.9	16.3	-
S.E.$_{\overline{X}}$	.018	.041	.057	.078	.132	.134	.214	-

Volution	RV 1	2	3	4	5	6	7
N	8	8	8	8	8	7	4
Max. Value	.156	.239	.373	.530	.783	1.165	1.470
Min. Value	.086	.129	.198	.310	.453	.663	1.221
$\overline{X}$	.118	.184	.276	.417	.630	.915	1.344
S	.021	.034	.058	.081	.129	.166	.111
C.V.	17.4	18.4	20.9	19.4	20.5	18.2	8.3
S.E.$_{\overline{X}}$	.007	.012	.020	.029	.046	.063	.056

Volution	Pro.Min.	Pro.Max.
N	7	7
Max. Value	170.5	172.7
Min. Value	98.5	120.5
$\overline{X}$	133.6	146.3
S	23.8	18.9
C.V.	17.9	13.0
S.E.$_{\overline{X}}$	9.0	7.2

Table 9, Part 1. Observed Variation in _Schwagerina pseudokaragasensis_

Volution	FR 1	2	3	4	5	6	7
N	8	8	8	8	8	7	4
Max. Value	2.00	2.57	2.66	2.71	2.95	3.01	2.58
Min. Value	1.19	1.58	1.71	1.55	1.72	2.20	2.30
$\overline{X}$	1.51	1.98	2.11	2.21	2.49	2.58	2.45
S	.31	.37	.33	.33	.38	.31	.12
C.V.	20.7	18.6	15.5	14.9	15.4	12.0	4.7
S.E.$_{\overline{X}}$	.11	.13	.12	.12	.14	.12	.06

Volution	PT 1	2	3	4	5	6	7
N	8	8	8	7	8	7	3
Max. Value	18.7	23.1	35.2	71.0	72.1	102.4	100.7
Min. Value	9.4	12.7	21.5	29.2	40.2	60.5	71.5
$\bar{X}$	12.8	18.1	26.2	44.0	58.9	73.5	88.2
S	3.0	3.4	4.6	13.9	13.6	13.5	15.0
C.V.	23.5	19.0	17.7	31.6	23.1	18.3	17.1
$S.E._{\bar{X}}$	1.1	1.2	1.6	5.3	4.8	5.1	8.7

Volution	TW 0	1	2	3	4	5	6
N	8	8	7	7	5	2	1
Max. Value	.050	.085	.126	.178	.356	.615	.368
Min. Value	.025	.046	.080	.111	.183	.260	.368
$\bar{X}$	.040	.062	.094	.136	.232	.437	-
S	.008	.012	.016	.023	.071	.251	-
C.V.	20.8	19.1	16.9	17.1	30.7	57.4	-
$S.E._{\bar{X}}$	.003	.004	.006	.009	.032	.177	-

Volution	TS 1-2	2-3	3-4	4-5	5-6	6-7
N	8	8	8	8	7	4
Max. Value	67.9	57.9	61.7	58.5	73.5	57.2
Min. Value	49.2	39.9	42.2	34.6	43.1	48.7
$\bar{X}$	55.7	49.3	51.6	50.8	51.1	52.7
S	6.7	6.6	5.9	9.9	10.5	3.7
C.V.	12.1	13.3	11.5	19.6	20.5	7.0
$S.E._{\bar{X}}$	2.4	2.3	2.1	3.5	4.0	1.8

Table 9, Part 2. Observed Variation in *Schwagerina pseudokaragasensis* and RC-9 from Zone B of the Alternating Limestone-Shale Member.

The description is based on eight axial and three sagittal sections.

Catalogue Numbers

Holotype, UA2056; paratypes, UA2050 through UA2055, and UA2057 through UA2060.

Schwagerina sp. A

Plate 2, figs. 1-5

Tables 10 and 11

Diagnosis

Shape: The test is irregularly fusiform with broadly rounded to bluntly pointed poles. The first volution is small, round to subglobose. Succeeding volutions are inflated fusiform and become progressively extended through the fourth volution when the general form of the adult shell is determined. The axis of coiling is straight.

Size: The test is of moderate size and specimens of 5.5 to 7 volutions range in length from 4.3 to 7.4 mm, and from 1.8 to 2.8 mm in width.

Number of Volutions: Adult individuals possess five to seven volutions. The outermost volution was commonly eroded, often making it impossible to take measurements.

Half Length: Mean values of half length for the first through sixth volutions are: .14/8, .33/8, .61/8, 1.06/7, 1.69/7, and 2.66/4 mm.

Radius Vector: Mean radius vectors for volutions one through six are: .11/8, .18/8, .28/8, .44/7, .73/7, and 1.12/3 mm respectively.

Wall: The spirotheca is composed of tectum and a comparatively fine-textured keriotheca. Heavy epithecal deposits commonly occur above the tectum. The protheca increases rapidly in thickness with mean values from the first through sixth volutions of: 14.9/8, 19.9/8, 29.2/7, 49.3/7, 74.2/7, and 99.2/3 microns respectively.

Chomata: Rudimentary chomata are present on the proloculus and the first 2 to 2.5 volutions. Well developed pseudochomata are present as a thickening of septa adjacent to the tunnel in the succeeding two volutions. Pseudochomata are generally absent in the outer volutions.

Axial Deposits: Very light secondary deposits are present in the volutions of the juvenarium. Small discontinuous deposits commonly occur along the axis in the polar regions.

Tunnel: The tunnel is generally well defined and has a straight to slightly irregular path. Mean values for tunnel width are: .03/8, .06/8, .10/8, .17/7, and .29/3 mm for the proloculus through the fourth volution.

Septa: The septa are rather thick and strongly but irregularly folded along their entire lengths. Septal loops may extend across the tunnel path, particularly in the outer volutions. Sagittal sections were not available for this species.

Form Ratio: Mean values of form ratio for the first through sixth volutions are: 1.32/8, 1.84/8, 2.19/8, 2.37/7, 2.33/7, and 2.56/3.

Tightness of Spire: The juvenarium is more tightly coiled than the rest of the shell but expands abruptly in the fourth volution and becomes more elongate. The mean percent increase of each volution beginning with computed values for volutions one and two are: 67.5/8, 56.2/8, 59.2/7, 64.4/7, 51.9/3.

Proloculus: The initial chamber is small with mean values for the maximum and minimum outside diameter of 119.4/8 and 109.3/8 microns.

Discussion

Distinguishing characteristics have been referred to previously for *Schwagerina* sp. A, *S.* cf. *S. emaciata*, and *S. pseudokaragasensis*

Table 10. Regression Analysis for *Schwagerina* sp. A

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	40	40	40	40
$\bar{X}_{RX}$	.901	.394	.394	41.125
$\bar{X}_{RY}$	.394	.901	41.125	.394
s_{RX}	.826	.303	.303	27.914
s_{RY}	.303	.826	27.914	.303
r	.967	.967	.967	.967
K	.354	2.637	89.048	.011
$S.E._K$	.015	.113	3.827	.001
b	.074	- .136	6.089	- .038
$S.E._{est.}$	.078	.213	7.241	.079

Table 11, Part 1. Observed Variation in *Schwagerina* sp. A

Volution	HL 1	2	3	4	5	6
N	8	8	8	7	7	4
Max. Value	.213	.453	.827	1.633	2.335	3.575
Min. Value	.108	.203	.348	.679	1.174	2.004
$\bar{X}$	.141	.327	.609	1.058	1.694	2.660
S	.033	.093	.155	.322	.401	.666
C.V.	23.1	28.3	24.4	30.4	23.7	25.0
S.E.$_{\bar{X}}$	.011	.033	.055	.122	.151	.333

Volution	RV 1	2	3	4	5	6	7
N	8	8	8	7	7	2	1
Max. Value	.142	.202	.329	.546	.859	1.190	1.501
Min. Value	.087	.146	.220	.368	.634	1.040	1.501
$\bar{X}$	.107	.177	.276	.443	.726	1.118	-
S	.018	.018	.037	.060	.077	.075	-
C.V.	16.5	10.1	13.5	13.6	10.6	6.7	-
S.E.$_{\bar{X}}$	.006	.006	.013	.023	.029	.043	-

Volution	Pro.Min.	Pro.Max.
N	8	8
Max. Value	109.3	143.6
Min. Value	95.7	105.6
$\bar{X}$	109.3	119.4
S	12.1	12.4
C.V.	11.0	10.4
S.E.$_{\bar{X}}$	4.3	4.4

Volution	FR 1	2	3	4	5	6
N	8	8	8	7	7	3
Max. Value	1.52	2.37	2.62	3.45	3.06	3.00
Min. Value	1.05	1.25	1.49	1.70	1.82	2.32
$\bar{X}$	1.32	1.84	2.19	2.37	2.33	2.56
S	.18	.42	.45	.58	.49	.38
C.V.	13.5	23.0	20.4	24.5	20.9	14.9
S.E.$_{\bar{X}}$	.06	.15	.16	.22	.18	.22

Volution	PT	1	2	3	4	5	6
N		8	8	7	7	7	3
Max. Value		24.8	28.1	37.4	73.7	87.5	102.4
Min. Value		11.0	13.2	23.1	40.2	64.9	96.3
$\bar{X}$		14.9	19.9	29.2	49.3	74.2	99.2
S		5.1	5.4	6.6	12.8	8.0	3.1
C.V.		34.2	27.2	22.7	26.0	10.7	3.1
S.E.$_{\bar{X}}$		1.8	1.9	2.5	4.8	3.0	1.8

Volution	TW	0	1	2	3	4
N		8	8	8	7	3
Max. Value		.050	.076	.130	.206	.368
Min. Value		.024	.042	.071	.117	.218
$\bar{X}$		.034	.059	.100	.171	.291
S		.008	.010	.019	.031	.075
C.V.		22.4	16.6	18.8	17.9	25.8
S.E.$_{\bar{X}}$		.003	.003	.007	.012	.043

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7
N		8	8	7	7	3	1
Max. Value		101.5	86.6	70.7	73.8	55.8	26.2
Min. Value		41.7	43.8	50.2	53.6	48.2	26.2
$\bar{X}$		67.5	56.2	59.2	64.4	51.9	-
S		20.0	13.1	7.2	8.1	3.8	-
C.V.		29.7	23.3	12.2	12.5	7.3	-
S.E.$_{\bar{X}}$		7.1	4.6	2.7	3.0	2.2	-

Table 11, Part 2. Observed Variation in Schwagerina sp. A

n. sp. Although S. sp. A and S. rowetti n. sp. have comparable growth rates (Tables 10 and 12), S. sp. A has a thinner protheca in the outer volutions, a smaller proloculus, and a shorter length of the fourth and fifth volutions.

A species was not formally designated as saggital sections were not available for septal counts.

Occurrence and Material

Schwagerina sp. A occurs in samples RC-8, RC-9, and RC-13 from Zone B of the Alternating Limestone-Shale Member.

The description is based on one oblique and seven axial sections.

Catalogue Numbers

UA2061 through UA2069.

Schwagerina rowetti Petocz, n. sp.

Plate 2, figs. 19-27

Tables 12 and 13

Diagnosis

Shape: The shell is fusiform with bluntly pointed poles. Some specimens are slightly inflated in the area of the midplane. The axis of coiling is straight.

Size: Specimens of 5.5 to 6 volutions range in length from 3.4 to 6.0 mm, and from 1.4 to 2.7 mm in width.

Number of Volutions: Individuals with five volutions are considered adult. Five of the ten study specimens have 5.5 to 6 volutions.

Half Length: The mean half lengths for the first through sixth volutions are: .18/9, .36/9, .65/9, 1.20/8, 1.94/9, and 2.64/5 mm.

Radius Vector: The means for radius vector for volutions one through six are: .13/10, .21/10, .31/10, .48/10, .77/10, and 1.14/6 mm respectively.

Wall: The spirotheca is composed of tectum and a comparatively coarse-textured keriotheca. The consistency of the protheca is somewhat irregular and commonly appears thicker at the base when in contact with septal arches of the preceeding volution. Alveoli are widely spaced and club-shaped. The protheca is thick in the outer chambers. Mean protheca thickness values for volutions one through six are: 15.1/10, 19.4/10, 27.8/10, 49.6/9, 82.5/9, and 104.6/2 microns.

Chomata: Rudimentary chomata are present on the proloculus and the first one or two volutions. Pseudochomata may be present along the tunnel on succeeding chambers but are irregular in development and do not occur in the last two volutions of adult specimens.

Axial Deposits: Secondary deposits along the axis are absent or occur only as poorly developed discontinuous patches.

Tunnel: The tunnel is apparent in the early volutions where it possesses a straight to slightly irregular path. In one sagittal section the tunnel height was about half that of the chambers. The width is rather narrow with mean values of: .04/10, .06/10, .09/10, .17/8, and .23/4 mm for the proloculus through the fourth volution.

Septa: The septa are strongly and regularly fluted throughout the test. Individual septal arches are high and broad, with convex sides. Many appear as small equilateral triangles, particularly in the outer volutions. The apex of the arches commonly are in contact with the succeeding chamber and are coated with secondary deposits. Fluting commonly disrupts the tunnel path in outer volutions. The septal count for one specimen for volutions one through four is: 11, 15, 22, and 23.

Form Ratio: Mean values for form ratio for the first through sixth volutions are: 1.38/9, 1.71/9, 2.15/9, 2.54/8, 2.55/9, and 2.16/5.

Tightness of Spire: The entire shell is comparatively loosely coiled with mean values for percent expansion of successive volutions of: 60.6/10, 47.1/10, 54.3/10, 60.3/10, and 49.5/6.

Proloculus: The initial chamber varies considerably in size, ranging from 130.9 to 238.7 microns in the maximum outside diameter. Mean values for the maximum and minimum outside diameter are 172.0 and 167.4 microns.

Discussion

Schwagerina rowetti n. sp. is similar in shape, wall thickness, and septal development to several forms of *S. urdalensis* (Rauser-Chernousova) from the Sakmarian of the southern Urals of the U.S.S.R. The distinguishing criteria between *S. rowetti* n. sp. and *S.* cf. *S. emaciata*, *S. pseudokaragasensis* n. sp., and *S.* sp. A have been previously discussed under these species. The species is named for Dr. Charles L. Rowett, University of Alaska.

Table 12. Regression Analysis for *Schwagerina rowetti*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	44	44	44	44
$\bar{X}_{RX}$	.902	.399	.399	40.455
$\bar{X}_{RY}$	.399	.902	40.455	.399
s_{RX}	.766	.293	.293	31.854
s_{RY}	.293	.766	31.854	.293
r	.966	.966	.932	.932
K	.370	2.524	101.323	.009
$S.E._K$	.015	.104	6.068	.001
b	.066	- .106	.025	.052
$S.E._{est.}$	.077	.200	11.662	.107

Volution	HL 1	2	3	4	5	6	7
N	9	9	9	8	9	5	1
Max. Value	.256	.502	.813	1.401	2.667	3.100	3.034
Min. Value	.112	.249	.476	.784	1.237	2.152	3.034
$\overline{X}$	.182	.360	.651	1.203	1.943	2.637	-
S	.056	.091	.128	.208	.441	.381	-
C.V.	30.8	25.4	19.6	17.3	22.7	14.4	-
S.E.$_{\overline{X}}$	.019	.030	.043	.073	.147	.170	-

Volution	RV 1	2	3	4	5	6
N	10	10	10	10	10	6
Max. Value	.182	.290	.439	.664	.946	1.388
Min. Value	.085	.147	.210	.320	.505	.695
$\overline{X}$	.133	.213	.314	.483	.770	1.135
S	.029	.047	.072	.105	.151	.265
C.V.	22.1	22.2	22.9	21.7	19.6	23.3
S.E.$_{\overline{X}}$	.009	.015	.023	.033	.048	.108

Volution	Pro.Min.	Pro.Max.
N	9	9
Max. Value	222.8	238.7
Min. Value	124.3	130.9
$\overline{X}$	167.4	172.0
S	27.0	30.4
C.V.	16.1	17.7
S.E.$_{\overline{X}}$	9.0	10.1

Table 13, Part 1. Observed Variation in <u>Schwagerina</u> <u>rowetti</u>

Volution	FR 1	2	3	4	5	6
N	9	9	9	8	9	5
Max. Value	1.76	2.03	3.32	3.63	3.52	2.42
Min. Value	1.00	1.31	1.75	2.11	1.97	1.94
$\overline{X}$	1.38	1.71	2.15	2.54	2.55	2.16
S	.25	.24	.46	.47	.51	.19
C.V.	18.3	14.3	21.5	18.4	20.1	8.7
S.E.$_{\overline{X}}$	.08	.08	.15	.17	.17	.08

Volution	PT 1	2	3	4	5	6
N	10	10	10	9	9	2
Max. Value	23.7	30.3	50.1	63.8	116.7	140.3
Min. Value	9.4	10.5	15.4	30.3	45.7	68.8
$\bar{X}$	15.1	19.4	27.8	49.6	82.5	104.6
S	4.1	6.4	11.7	12.5	21.8	50.6
C.V.	27.3	32.8	42.1	25.3	26.5	48.4
S.E.$_{\bar{X}}$	1.3	2.0	3.7	4.2	7.3	35.8

Volution	TW 0	1	2	3	4
N	10	10	10	8	4
Max. Value	.051	.079	.129	.239	.294
Min. Value	.026	.045	.060	.119	.174
$\bar{X}$	.037	.061	.094	.167	.226
S	.008	.010	.023	.044	.050
C.V.	21.4	15.9	24.1	26.1	22.1
S.E.$_{\bar{X}}$	.003	.003	.007	.015	.025

Volution	TS 1-2	2-3	3-4	4-5	5-6
N	10	10	10	10	6
Max. Value	80.6	61.4	62.0	76.6	55.8
Min. Value	42.6	39.6	46.9	40.3	37.7
$\bar{X}$	60.6	47.1	54.3	60.3	49.5
S	10.0	7.3	5.0	11.5	6.3
C.V.	16.6	15.5	9.2	19.0	13.8
S.E.$_{\bar{X}}$	3.2	2.3	1.6	3.6	2.8

Table 13, Part 2. Observed Variation in *Schwagerina rowetti*

Occurrence and Material

Schwagerina rowetti n. sp. occurs in samples RC-15, DR-14, RC-16, and RC-17 from the upper-middle and upper part of the Alternating Limestone-Shale Member.

This description is based on ten axial, one sagittal and three oblique sections.

Catalogue Numbers

Holotype, UA2077; paratypes, UA2070 through UA2076, and UA2078 through UA2083.

Schwagerina callosa (Rauser-Chernousova)

Plate 4, figs. 1-7

Tables 14 and 15

Pseudofusulina callosa, Rauser-Chernousova, 1940, p. 88-89, Plate 5, figs. 5-7.

Pseudofusulina callosa (Rauser-Chernousova), Rauser-Chernousova, 1965, p. 71-72, Plate 6, figs. 5-6.

Diagnosis

Shape: The shell is fusiform with broadly rounded poles. Some specimens become slightly extended in the last two volutions. The axis of coiling is straight to irregular.

Size: Individuals of six to seven volutions range in length from about 5.0 to 7.9 mm, and from 2.0 to 2.8 mm in width. One specimen of seven volutions was almost 9 mm long.

Number of Volutions: Mature individuals have six to seven volutions. Most of the study specimens were badly eroded and it was impossible to record accurate measurements for the last volutions.

Half Length: Mean half lengths for the first through the sixth volutions are: .21/6, .48/6, .82/6, 1.27/5, 2.35/5, and 3.12/3 mm.

<u>Radius Vector:</u> Average values for radius vector for volutions one through six are: .13/6, .22/6, .33/6, .52/5, .76/4, and 1.12/3 mm respectively.

<u>Wall:</u> The spirotheca is composed of tectum and a moderately coarse-textured keriotheca. The protheca is of uneven consistency, particularly in the outer volutions. Epithecal deposits are present above the tectum but vary considerably in amount between volutions, and in individual specimens. The mean protheca thicknesses for the first through the sixth volutions are: 16.0/6, 25.2/6, 37.2/6, 55.0/5, 80.3/4, and 85.6.3 microns.

<u>Chomata:</u> Low rudimentary chomata generally occur on the proloculus and first volution. Pseudochomata are present but are poorly developed on the succeeding two to three volutions.

<u>Axial Deposits:</u> In most of the specimens secondary deposits are light and interrupted along the axis. One specimen had more massive deposits, indicating that there is probably a continuum of variation for this character.

<u>Tunnel:</u> The tunnel is narrow and evident in the inner volutions, where it follows an irregular path. Tunnel height is about half that of the chambers but apparently increases somewhat in the later volutions. Mean tunnel widths for the proloculus through the third volution are: .04/6,

.06/6, .11/5, and .17/6 mm.

Septa: The septa are strongly and rather irregularly fluted from pole to pole. The arches tend to be angular to distorted with the apex frequently reaching succeeding volutions. Fluting may traverse the tunnel path in outer volutions. Septal count for one specimen is: ?, 24, 28, 27, and 31.

Form Ratio: Mean values for form ratio for the first through sixth volutions are: 1.59/6, 2.17/6, 2.46/6, 2.44/5, 2.95/3, and 2.81/3.

Tightness of Spire: The first 1.5 volutions are more tightly coiled than the rest of the shell. Mean values for the percent increase of each volution are: 65.3/6, 52.7/6, 54.2/5, 50.2/4, and 51.5/3.

Proloculus: The proloculus ranges from 103.4 to 199.7 microns in maximum outside diameter. Mean values for the maximum and minimum outside diameter are 169.8 and 155.0 microns respectively.

Discussion

There is close agreement in all measured and qualitative parameters with the original descriptions of Schwagerina callosa (Rauser-Chernousova) from the Sterlitamak horizon of the southern Urals (Rauser-Chernousova, 1940). Proloculus size differs only slightly, ranging from 150 to 240 microns in the Russian forms and 103.4 to 199.7 microns in

Table 14. Regression Analysis for *Schwagerina callosa*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	29	29	29	29
$\bar{X}_{RX}$	1.098	.429	.429	43.197
$\bar{X}_{RY}$	.429	1.098	43.197	.429
s_{RX}	.954	.317	.317	26.624
s_{RY}	.317	.954	26.624	.317
r	.983	.983	.936	.936
K	.327	2.959	78.664	.011
$S.E._K$	.012	.106	5.675	.001
b	.070	- .172	9.458	- .053
$S.E._{est.}$	.059	.178	9.517	.113

Volution	HL 1	2	3	4	5	6	7
N	6	6	6	5	5	3	1
Max. Value	.262	.590	1.033	1.597	2.663	3.349	4.418
Min. Value	.125	.358	.564	.984	2.043	2.752	4.418
$\overline{X}$	.212	.477	.824	1.271	2.348	3.122	-
S	.052	.089	.183	.287	.292	.323	-
C.V.	24.6	18.7	22.2	22.5	12.5	10.4	-
S.E.$_{\overline{X}}$	.021	.036	.075	.128	.131	.186	-

Volution	RV 1	2	3	4	5	6
N	6	6	6	5	4	3
Max. Value	.147	.260	.415	.609	.851	1.279
Min. Value	.106	.176	.283	.426	.670	1.001
$\overline{X}$	.132	.219	.334	.516	.764	1.120
S	.016	.027	.044	.073	.092	.143
C.V.	12.2	12.3	13.3	14.2	12.1	12.8
S.E.$_{\overline{X}}$	.007	.011	.018	.033	.046	.083

Volution	Pro.Min.	Pro.Max.
N	6	6
Max. Value	185.14	199.7
Min. Value	100.7	103.4
$\overline{X}$	155.0	169.8
S	32.8	35.1
C.V.	21.2	20.7
S.E.$_{\overline{X}}$	13.4	14.3

Table 15, Part 1. Observed Variation in *Schwagerina callosa*

Volution	FR 1	2	3	4	5	6
N	6	6	6	5	3	3
Max. Value	2.06	2.50	3.20	2.90	3.11	3.34
Min. Value	1.18	1.80	1.78	2.22	2.81	2.54
$\overline{X}$	1.59	2.17	2.46	2.44	2.95	2.81
S	.32	.25	.45	.28	.15	.46
C.V.	19.9	11.3	18.3	11.5	5.1	16.3
S.E.$_{\overline{X}}$	.13	.10	.18	.13	.09	.27

Volution	PT	1	2	3	4	5	6
N		6	6	6	5	4	3
Max. Value		19.3	31.4	51.2	74.3	97.4	107.3
Min. Value		12.7	22.6	23.7	41.3	71.0	69.3
$\overline{X}$		16.0	25.2	37.2	55.0	80.3	85.6
S		2.5	3.2	9.7	12.5	12.4	19.6
C.V.		15.7	12.7	26.0	22.7	15.4	22.8
$S.E._{\overline{X}}$		1.0	1.3	4.0	5.6	6.2	11.3

Volution	TW	0	1	2	3	4	5
N		6	6	5	6	1	1
Max. Value		.050	.079	.144	.303	.562	.514
Min. Value		.036	.042	.093	.118	.562	.514
$\overline{X}$		.043	.062	.109	.191	-	-
S		.006	.013	.021	.066	-	-
C.V.		14.5	20.4	19.5	34.7	-	-
$S.E._{\overline{X}}$		.003	.005	.009	.027	-	-

Volution	TS	1-2	2-3	3-4	4-5	5-6
N		6	6	5	4	3
Max. Value		76.7	60.7	73.0	57.1	61.3
Min. Value		48.9	40.5	44.9	39.7	42.9
$\overline{X}$		65.3	52.7	54.2	50.2	51.5
S		10.1	8.8	11.3	7.4	9.3
C.V.		15.4	16.7	20.9	14.8	18.0
$S.E._{\overline{X}}$		4.1	3.6	5.1	3.7	5.4

Table 15, Part 2. Observed Variation in *Schwagerina callosa* the Alaskan types. She did not include septal counts in the original descriptions; however, the data from one specimen is included in this diagnosis.

S. callosa (Rauser-Chernousova) is similar in certain aspects to several species from the Sterlitamak horizon of the Urals. S. blochini (Korzhenevsky) is distinguished from this species by its much larger size, thicker protheca, and thicker septa. S. kutkanensis (Rauser-Chernousova) differs in its larger size, more elongate test, and less extensive axial deposits. S. karagasensis (Rauser-Chernousova) is wider and is generally free of axial deposits. S. pseudokaragasensis n. sp., from a lower horizon in the Alternating Limestone-Shale Member, has significantly smaller values for half length and radius vector, it more regularly fluted, has fewer septa per volution, and smaller form ratios in the outer volutions.

Unfortunately, I was not able to study the descriptions of the forms from northern Fergana (Bensh, 1962) or the Timan forms reported by Grozdilova and Lebedeva (1961). According to Rauser-Chernousova (1965, p. 71-72), these forms agree satisfactorily with the original descriptions.

Occurrence and Material

Schwagerina callosa (Rauser-Chernousova) occurs in Zones B and C of the Alternating Limestone-Shale Member in samples RC-13, RC-16, RC-17, and RC-19. The same species is found in the upper part of the

Sterlitamak horizon of the Sakmarian series in several localities in the southern Urals.

This description is based on six axial, one sagittal, and three oblique sections.

Catalogue Numbers

UA2084 through UA2093.

<u>Schwagerina</u> <u>whartoni</u> Petocz, n. sp.

Plate 3, figs. 1-5

Tables 16 and 17

Diagnosis

<u>Shape</u>: The shell is elongate fusiform with bluntly pointed poles. The axis of coiling is straight.

<u>Size:</u> Mature individuals of 5.5 to 6 volutions range in length from 6.2 to 9.5 mm, and from 1.8 to 3.2 mm in width.

<u>Number of Volutions:</u> All adult individuals have at least 5.5 volutions and

may possess up to seven.

Half Length: Mean half lengths for the first through sixth volution are: .20/27, .46/27, .89/27, 1.56/27, 2.54/22, and 3.41/11 mm.

Radius Vector: The mean radius vectors for volutions one through six are: .14/27, .23/27, .38/27, .61/27, .91/21, and 1.22/11 mm respectively.

Wall: The spirotheca is composed of tectum and a moderately coarse-textured keriotheca. The consistency of the protheca is irregular in most specimens. Long and short alveoli are alternately spaced in the protheca of the outer volutions. The longer alveoli have noticeably thickened chamber ends. Epithecal deposits are lacking on the tectum. Mean values of protheca thickness for the first through sixth volutions are: 14.7/27, 23.9/26, 39.2/26, 64.6/25, 83.3/18, and 89.0/10 microns.

Chomata: Chomata are present on the proloculus and the first one to two volutions. Pseudochomata occur irregularly on the succeeding two volutions but are generally poorly developed. Secondary deposits, which are apparently continuous with the chomata or pseudochomata, frequently occur in an arch over the tunnel path (Plate 3, fig. 10).

Axial Deposits: Secondary axial filling is absent to extremely light. When such deposits occur, they are usually confined to the first three volutions.

Tunnel: The tunnel is well defined in the inner volutions and has a straight to slightly irregular path. Its height is about half that of the chambers, but increases in the outer whorls. Septal fluting may occur across the path in the outer volutions, often rendering it difficult to make appropriate measurements. The tunnel is comparatively wide with mean values for the proloculus through the fifth volution of: .06/25, .10/25, .19/23, .34/17, .67/12, and .65/2 mm respectively.

Septa: The septa are moderately to strongly fluted with the arches commonly reaching the base of adjacent chambers, both in the midplane and the polar regions. Septal arches are normally broad and rounded, and more rarely, angular. Many specimens have septa which are broader and irregularly folded across the midplane of outer volutions. Septal pores are abundantly present and are best developed in the arches of the polar regions. The mean values of septal counts for the first through the fifth volution are: 11.5/4, 18.0/4, 19.0/4, 20.8/4, and 26.5/4.

Form Ratio: Mean values of form ratio for volutions one through six are: 1.41/27, 1.97/27, 2.33/27, 2.56/27, 2.87/20, and 2.92/10.

Tightness of Spire: The chambers are loosely coiled throught the test. The mean values for percent expansion of each volution are: 63.8/27, 63.5/27, 61.9/27, 54.2/21, and 43.6/11.

Proloculus: The initial chamber varies in size, ranging from 123.8 to

230.5 microns for the maximum outside diameter. Mean values for the maximum and minimum diameter are 184.1 and 170.0 microns.

Discussion

Schwagerina whartoni n. sp. is similar in all respects of evolutionary development to a group of species including S. sulcata (Korzhenevsky), S. ischimbajevi (Korzhenevsky), S. rauserae (Korzhenevsky), and S. moelleri (Schellwien) from the subsurface Sakmarian limestones at Ishimbajeva, southern Urals. S. sulcata (Korzhenevsky) may be distinguished by its more cylindrical form, and somewhat thicker protheca, while S. ischimbajevi (Korzhenevsky) and S. rauserae (Korzhenevsky) are both longer, have larger proloculi, a much thicker protheca, and more numerous septa per volution. The latter species also has axial deposits. S. moelleri (Schellwien) differs in that it has more numerous volutions and thicker protheca in the outer volutions.

This species is named in memory of George B. Wharton, fellow graduate student and friend at the University of Alaska.

Occurrence and Material

Schwagerina whartoni n. sp. occurs in Zones B and C in the Alternating Limestone-Shale Member in samples RC-11, RC-12, RC1-5, and DR-14. The comparable Russian species as reported by Korzhenevsky

Table 16. Regression Analysis for Schwagerina whartoni

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	130	130	130	130
$\bar{X}_{RX}$	1.201	.473	.473	45.033
$\bar{X}_{RY}$	.473	1.201	45.033	.473
s_{RX}	1.064	.338	.338	29.138
s_{RY}	.338	1.064	29.138	.338
r	.970	.970	.885	.885
K	.308	3.055	76.348	.010
$S.E._K$	.007	.068	3.550	.001
b	.103	- .244	8.946	.011
$S.E._{est.}$	.083	.260	13.618	.158

Volution	HL 1	2	3	4	5	6	7
N	27	27	27	27	22	11	1
Max. Value	.305	.708	1.561	2.214	3.651	4.805	4.362
Min. Value	.102	.184	.400	.915	1.732	2.611	4.362
$\bar{X}$	.199	.457	.881	1.563	2.540	3.409	-
S	.055	.136	.260	.377	.519	.701	-
C.V.	27.8	29.7	29.6	24.1	20.4	20.6	-
S.E.$_{\bar{X}}$	.011	.026	.050	.073	.111	.211	-

Volution	RV 1	2	3	4	5	6
N	27	27	27	27	21	11
Max. Value	.230	.348	.554	.865	1.235	1.412
Min. Value	.083	.146	.220	.362	.557	.902
$\bar{X}$	.142	.232	.379	.612	.912	1.220
S	.030	.046	.075	.114	.166	.193
C.V.	21.2	19.8	19.7	18.6	18.2	16.4
S.E.$_{\bar{X}}$	.006	.009	.014	.022	.036	.055

Volution	Pro.Min.	Pro.Max.
N	26	26
Max. Value	205.2	230.5
Min. Value	122.1	123.8
$\bar{X}$	170.0	184.1
S	23.3	31.2
C.V.	13.7	16.9
S.E.$_{\bar{X}}$	4.6	6.1

Table 17, Part 1. Observed Variation in *Schwagerina whartoni*

Volution	FR 1	2	3	4	5	6
N	27	27	27	27	27	10
Max. Value	2.20	2.98	4.08	3.35	3.79	3.86
Min. Value	.95	1.16	1.54	1.55	1.71	2.13
$\bar{X}$	1.41	1.97	2.33	2.56	2.87	2.92
S	.32	.48	.56	.44	.45	.51
C.V.	22.8	24.4	24.0	17.1	15.8	17.3
S.E.$_{\bar{X}}$	.06	.09	.11	.08	.10	.16

Volution	PT	1	2	3	4	5	6	7
N		27	26	26	25	18	10	1
Max. Value		29.2	52.8	60.5	99.6	114.5	142.5	99.0
Min. Value		7.7	16.0	14.9	22.0	42.9	66.0	99.0
$\bar{X}$		14.7	23.9	39.2	64.6	83.3	89.0	-
S		4.3	7.6	10.4	17.3	18.6	21.0	-
C.V.		28.9	31.9	26.6	26.8	22.4	23.6	-
$S.E._{\bar{X}}$		.8	1.5	2.0	3.5	4.4	6.6	-

Volution	TW	0	1	2	3	4	5
N		25	25	23	17	12	2
Max. Value		.085	.142	.314	.638	1.237	.686
Min. Value		.029	.053	.098	.193	.340	.623
$\bar{X}$		.057	.101	.185	.338	.673	.654
S		.012	.025	.061	.117	.288	.045
C.V.		21.1	24.4	33.2	34.7	42.9	6.8
$S.E._{\bar{X}}$		.002	.005	.013	.028	.083	.032

Volution	TS	1-2	2-3	3-4	4-5	5-6
N		27	27	27	21	11
Max. Value		106.9	83.3	89.5	74.2	59.9
Min. Value		45.4	46.3	47.0	39.1	33.6
$\bar{X}$		63.8	63.5	61.9	54.2	43.6
S		11.4	10.0	9.2	8.2	7.7
C.V.		17.9	15.7	14.8	15.1	17.7
$S.E._{\bar{X}}$		2.2	1.9	1.8	1.8	2.3

Table 17, Part 2. Observed Variation in *Schwagerina whartoni*

(1940) and more recently by Rauser-Chernousova (1965), occur in rocks in the southern Ural area of the U.S.S.R. that range from early Asselian through middle Sakmarian (Middle Tastuba horizon) in age.

This description is based on 27 axial, 4 sagittal, and 3 oblique sections.

Catalogue Numbers

Holotype, UA2103; paratypes, UA2094 through UA2102, and UA2104 through UA2127.

Schwagerina heineri Petocz, n. sp.

Plate 5, figs. 1-2, and 14

Tables 18 and 19

Diagnosis

Shape: The shell is fusiform to subelliptical with broadly rounded to bluntly pointed poles. The axis of coiling is straight.

Size: Mature specimens of seven to eight volutions range from 4.6 to 6.3

mm in length, and from 2.5 to 3.4 mm in width.

Number of Volutions: Mature individuals possess at least 6.5 to 7 volutions. Eight of 35 specimens had eight volutions.

Half Length: Mean values of half length for the first through the eighth volutions are: .10/34, .22/34, .44/34, .78/29, 1.26/32, 1.89/29, 2.58/20, and 3.19/8 mm respectively.

Radius Vector: Mean radius vectors for volutions one through eight are: .08/35, .12/35, .19/35, .29/35, .46/34, .76/29, 1.10/15, and 1.41/4 mm.

Wall: The spirotheca is composed of tectum and a comparatively fine textured keriotheca. The wall structure is diffuse throughout most of the test and alveoli are not apparent in the volutions of the juvenarium. Epithecal deposits occur irregularly on the tectum. The thickness of the protheca commonly is inconsistent, having mean values for the first through eighth volutions of: 12.6/34, 16.7/34, 23.6/31, 34.3/34, 48.0/31, 66.5/23, 77.5/13, and 77.2/4 microns respectively.

Chomata: Low chomata are usually developed on the proloculus and the first 2 to 2.5 volutions. Pseudochomata are at best poorly developed as slight secondary thickenings of septa adjacent to the tunnel, and occur irregularly on one to two volutions succeeding the juvenarium.

Axial Deposits: The presence of secondary axial filling varies considerably in this species (Plate 5, figs. 1, 4, and 5). Normally only light axial deposits occur in the third through sixth volutions.

Tunnel: The tunnel is narrow and best defined in the inner volutions, where it follows an irregular path. Its height is low, about half that of the chambers. Mean values for tunnel width for the proloculus through the fifth volution are: .03/20, .04/34, .06/33, .11/35, .22/11, and .26/3 mm.

Septa: Fluting is intense, high and regular throughout the test. Septal arches are generally narrow with parallel sides and may be partially or entirely filled with secondary deposits, particularly in the inner volutions. The apex of the folds commonly reach the base of the succeeding volution. Mean septal counts for the first through sixth volutions are: 9.3/4, 13.8/4, 17.3/4, 20.3/4, 22.5/4, and 28/5.

Form Ratio: Mean values for the form ratio in volutions one through eight are: 1.32/34, 1.86/34, 2.37/34, 2.68/29, 2.78/32, 2.57/29, 2.33/15, and 2.19/4.

Tightness of Spire: The juvenarium is more tightly coiled than the ensuing volutions. Mean percent values for expansion by volution are: 54.9/35, 53.8/35, 54.1/35, 59.6/34, 64.6/29, 62.9/15, and 46.7/4.

Table 18. Regression Analysis for _Schwagerina heineri_

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	193	193	193	193
$\bar{X}_{RX}$	.882	.364	.364	34.983
$\bar{X}_{RY}$	.364	.882	34.983	.364
s_{RX}	.818	.340	.340	23.346
s_{RY}	.340	.818	23.346	.340
r	.963	.963	.902	.902
K	.400	2.316	61.879	.013
$S.E._K$	.008	.471	2.148	.001
b	.011	.039	12.477	- .096
$S.E._{est.}$	.092	.222	10.123	.148

Volution	HL 1	2	3	4	5	6	7	8
N	34	34	34	29	32	29	20	8
Max. Value	.157	.482	.676	1.210	1.794	2.654	3.287	3.644
Min. Value	.066	.134	.298	.459	.695	1.204	1.702	2.286
$\bar{X}$	.102	.223	.443	.775	1.262	1.894	2.582	3.186
S	.025	.065	.105	.178	.270	.307	.342	.436
C.V.	24.1	29.2	24.0	23.0	21.4	16.2	13.2	13.7
S.E.$_{\bar{X}}$	.004	.011	.018	.033	.048	.057	.076	.154

Volution	RV 1	2	3	4	5	6	7	8
N	35	35	35	35	34	29	15	4
Max. Value	.110	.172	.261	.389	.690	1.200	1.432	1.737
Min. Value	.052	.087	.126	.194	.279	.429	.621	.943
$\bar{X}$	.078	.122	.187	.288	.462	.759	1.100	1.410
S	.014	.022	.033	.052	.095	.173	.193	.338
C.V.	17.3	18.1	17.6	18.0	20.5	22.7	17.6	24.0
S.E.$_{\bar{X}}$	.002	.004	.006	.009	.016	.032	.050	.169

Volution	Pro.Min.	Pro.Max.
N	33	34
Max. Value	116.1	137.5
Min. Value	55.6	66.0
$\bar{X}$	85.3	94.5
S	15.9	16.1
C.V.	18.6	17.0
S.E.$_{\bar{X}}$	2.8	2.8

Table 19, Part 1. Observed Variation in _Schwagerina heineri_

Volution	FR 1	2	3	4	5	6	7	8
N	34	34	34	29	32	29	15	4
Max. Value	1.78	3.36	3.59	3.59	3.96	3.68	2.89	2.42
Min. Value	.86	1.23	1.56	1.63	1.53	1.77	1.81	1.93
$\bar{X}$	1.32	1.86	2.38	2.68	2.78	2.57	2.33	2.19
S	.26	.49	.45	.42	.53	.43	.31	.25
C.V.	19.4	26.3	18.9	15.7	18.9	18.6	13.2	11.6
S.E.$_{\bar{X}}$	.04	.08	.08	.08	.09	.09	.08	-

Volution	PT 1	2	3	4	5	6	7	8
N	34	34	31	34	31	23	13	4
Max. Value	19.3	27.5	34.7	61.6	71.5	97.4	97.4	91.3
Min. Value	7.7	9.9	12.7	22.0	20.9	37.4	46.8	69.3
$\bar{X}$	12.6	16.3	23.6	34.3	48.0	66.5	77.5	77.2
S	3.1	5.0	6.5	11.2	12.3	15.6	13.1	10.0
C.V.	24.8	30.0	27.7	32.6	25.6	23.4	16.8	13.0
S.E.$_{\bar{X}}$	.5	.9	1.2	1.9	2.2	3.2	3.6	5.0

Volution	TW 0	1	2	3	4	5
N	20	34	33	35	11	3
Max. Value	.036	.061	.119	.187	.409	.307
Min. Value	.017	.020	.031	.055	.105	.200
$\bar{X}$	.026	.035	.059	.106	.223	.261
S	.006	.009	.019	.025	.089	.055
C.V.	22.8	24.3	31.8	23.6	39.9	21.1
S.E.$_{\bar{X}}$	.001	.001	.003	.004	.027	.032

Volution	TS 1-2	2-3	3-4	4-5	5-6	6-7	7-8
N	35	35	35	34	29	15	4
Max. Value	81.8	75.6	65.3	96.1	91.3	76.4	54.3
Min. Value	37.0	32.7	40.7	42.2	39.1	44.8	34.7
$\bar{X}$	54.9	53.8	54.1	59.6	64.5	62.9	46.7
S	11.3	9.1	7.4	11.7	11.9	10.4	8.7
C.V.	20.6	17.0	13.8	19.5	18.4	16.5	18.6
S.E.$_{\bar{X}}$	1.9	1.6	1.3	2.0	2.2	2.7	4.4

Table 19, Part 2. Observed Variation in Schwagerina heineri

Proloculus: The proloculus is small with mean values of the maximum and minimum outside diameter of 94.5/34 and 85.3/33 microns.

Discussion

Schwagerina heineri n. sp. does not closely resemble any other described species. It may be endemic to the Boreal faunal realm. The species is named for Lawrence E. Heiner, University of Alaska.

Occurrence and Material

Schwagerina heineri n. sp. occurs only in the lowermost part of the Limestone Member in Zone D and is abundantly present in sample RC-22. This species was also found in samples RC-23 and RC-21 (?).

This description is based on 35 axial, 6 sagittal, and numerous oblique sections. Additional axial sections were studied but were not measured.

Catalogue Numbers

Holotype, UA2148; paratypes, UA2137 through UA2147, and UA2149 through UA2194.

Schwagerina moffiti Petocz, n. sp.

Plate 4, figs. 8-13

Tables 20 and 21

Diagnosis

Shape: The shell is thickly subcylindrical to subcylindrical with bluntly rounded poles. The first volution is ovoidal and all succeeding volutions fusiform, becoming extended by the fourth or fifth volution. The axis of coiling is straight or gently arched. Most specimens are slightly constricted in the area of the tunnel.

Size: Individual of 7 to 7.5 volutions range in length from 8.9 to 11.1 mm, and from 2.7 to 2.9 mm in width.

Number of Volutions: Mature individuals possess 6.5 to 7.5 volutions.

Half Length: The mean values for half length for volutions one through seven are: .16/6, .37/5, .72/6, 1.28/5, 2.07/6, 2.83/4, and 4.32/4 mm.

Radius Vector: Average radius vectors for the first through the seventh volutions are: .11/6, .16/6, .25/6, .39/6, .60/6, .90/4, and 1.34/2 mm.

Wall: The spirotheca is composed of tectum and a moderate-to-fine textured keriotheca. The protheca is somewhat irregular in thickness and of rather diffuse structure. Epitheca is thin to absent above the tectum. The protheca is thick with mean thickness values for the first through the seventh volutions of: 14.5/6, 19.1/6, 31.0/6, 44.3/4, 62.6/5, 82.8/4, and 103.5/2 microns respectively.

Chomata: Rudimentary chomata normally are present on the proloculus and first 1.5 volutions. Pseudochomata are very poorly developed and occur irregularly on the two succeeding volutions.

Axial Deposits: In some specimens light secondary deposits occur along the axis of the first several volutions. Apparently there is much variability in this character.

Tunnel: The tunnel is low and generally less than half the chamber height in all volutions. Tunnel path is straight to irregular. The path sometimes is difficult to discern as it may be obscured by septal fluting. Mean values for tunnel width for the proloculus through fourth volution are: .04/4, .06/5, .09/5, .12/5, and .27/3 mm.

Septa: The septa are very regular, high, and intensely fluted throughout the shell. The form of the arches is irregular. The apex of the folds commonly reaches the base of succeeding volutions. Septal loops of the inner volutions are generall filled with secondary deposits. Septal counts for one specimen for volutions one through five are: 14, 18, 23, 24, and 25.

Form Ratio: Mean values for form ratio for the firth through the seventh volutions are: 1.47/8, 2.17/5, 2.84/6, 3.13/5, 3.54/6, 3.24/4, and 3.51/2.

Tightness of Spire: The first two volutions are more tightly coiled than the remainder of the test. Mean values for percent expansion of successive volutions are: 51.8/6, 53.9/6, 54.7/6, 52.2/6, 57.7/4, and 60.4/2.

Proloculus: The initial chamber is small with mean values of the maximum and minimum outside diameter of 160.8/4 and 142.3/4 microns.

Discussion

Schwagerina moffiti n. sp. is similar in may respects to *S. kutkanensis* Rauser-Chernousova from the upper Sakmarian and Artinskian rocks in the southern Urals. *S. moffiti* differs in having more volutions, significantly smaller diameters for all volutions, and much variation in axial deposits. *S. juresanensis* (Rauser-Chernousova) from the Artinskian of the southern Urals differs in its more elongate form and less intensely fluted septa. Some examples of *S. hyperborea* (Salter) described here from much higher horizons in the Upper Delta River section, as well as described species from the Belcher Channel Formation in the Arctic Archipelago and the Tahkandit Formation of northern Yukon Territory are similar

Table 20. Regression Analysis for *Schwagerina moffiti*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	30	30	30	30
$\bar{X}_{RX}$	1.210	.401	.401	41.787
$\bar{X}_{RY}$	.401	1.210	41.787	.401
s_{RX}	1.108	.326	.326	27.980
s_{RY}	.326	1.108	27.980	.326
r	.924	.924	.946	.946
K	.272	3.142	81.151	.011
$S.E._K$	.021	.245	5.282	.001
b	.072	− .050	9.248	− .059
$S.E._{est.}$	.127	.431	9.273	.108

Volution	HL 1	2	3	4	5	6	7	8
N	6	5	6	5	6	4	4	1
Max. Value	.223	.525	.964	1.683	2.690	3.523	5.635	4.595
Min. Value	.082	.236	.364	.935	1.443	2.283	3.641	4.595
$\bar{X}$	.162	.371	.716	1.279	2.065	2.834	4.322	-
S	.052	.109	.236	.297	.525	.588	.909	-
C.V.	31.8	29.5	33.0	23.2	25.4	20.8	21.0	-
$S.E._{\bar{X}}$	.021	.049	.096	.133	.214	.294	.454	-

Volution	RV 1	2	3	4	5	6	7
N	6	6	6	6	6	4	2
Max. Value	.125	.182	.303	.450	.744	1.113	1.359
Min. Value	.086	.141	.211	.298	.455	.739	1.327
$\bar{X}$	.109	.164	.253	.392	.600	.895	1.343
S	.015	.018	.036	.063	.119	.176	.023
C.V.	13.9	11.2	14.0	16.1	19.8	19.6	1.7
$S.E._{\bar{X}}$	.006	.007	.015	.026	.048	.088	.016

Volution	Pro.Min.	Pro.Max.
N	4	4
Max. Value	155.1	189.8
Min. Value	110.6	116.1
$\bar{X}$	142.3	160.8
S	21.2	31.9
C.V.	14.9	19.9
$S.E._{\bar{X}}$	10.6	16.0

Table 21, Part 1. Observed Variation in *Schwagerina moffiti*

Volution	FR 1	2	3	4	5	6	7
N	6	5	6	5	6	4	2
Max. Value	1.83	2.87	3.67	4.00	4.33	4.06	4.15
Min. Value	.95	1.66	1.65	2.07	1.94	2.16	2.86
$\bar{X}$	1.47	2.17	2.84	3.13	3.54	3.24	3.51
S	.37	.50	.93	.71	.97	.82	.91
C.V.	25.1	23.0	32.6	22.7	27.4	25.4	26.0
$S.E._{\bar{X}}$	.15	.22	.38	.32	.40	.41	.65

Volution	PT	1	2	3	4	5	6	7
N		6	6	6	4	5	4	2
Max. Value		19.3	29.2	42.9	57.8	88.0	97.9	109.5
Min. Value		11.0	13.2	16.5	30.8	39.1	66.6	97.4
$\overline{X}$		14.5	19.1	31.0	44.3	62.6	82.8	103.5
S		3.1	5.9	8.9	14.1	18.0	12.8	8.6
C.V.		21.5	31.0	28.7	31.8	28.8	15.5	8.3
S.E.$_{\overline{X}}$		1.3	2.4	3.6	7.0	8.1	6.4	6.1

Volution	TW	0	1	2	3	4	5
N		4	5	5	5	3	1
Max. Value		.042	.078	.109	.192	.386	.316
Min. Value		.025	.033	.059	.079	.199	.316
$\overline{X}$		.036	.055	.085	.120	.269	-
S		.008	.018	.020	.046	.102	-
C.V.		20.9	32.6	23.6	38.4	38.0	-
S.E.$_{\overline{X}}$		.004	.008	.009	.021	.059	-

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7
N		6	6	6	6	4	2
Max. Value		64.6	70.3	63.7	65.1	68.8	79.6
Min. Value		39.6	48.0	41.3	38.8	49.6	41.2
$\overline{X}$		51.8	53.9	54.7	52.2	57.7	60.4
S		10.6	8.7	8.6	9.4	8.6	27.2
C.V.		20.5	16.1	15.7	18.0	14.8	45.0
S.E.$_{\overline{X}}$		4.3	3.5	3.5	3.8	4.3	19.2

Table 21, Part 2. Observed Variation in *Schwagerina moffiti* in shape and septal development but are readily distinguished by their larger size and denser axial deposits.

The species is named for Fred C. Moffit, U.S. Geological Survey geologist, who has made significant contributions to the geology of the east central Alaska Range.

Occurrence and Material

Schwagerina moffiti n. sp. occurs in sample RC-20 from Zone D in the highest part of the Alternating Limestone-Shale Member. No other fossils are present in this sample.

This description is based on six axial, one sagittal, and two oblique sections.

Catalogue Numbers

Holotype, UA2132; paratypes, UA2128 through UA2131, and UA2133 through UA2136.

Schwagerina sp. B

Plate 5, figs. 13 and 15

Table 22

Diagnosis

Shape: The shell is fusiform with bluntly pointed poles. The axis of coiling is straight to gently arched. The first one or two volutions are globose to ovoidal; all succeeding volutions are fusiform.

Size: Individuals of six to eight volutions range in length from 3.0 to 7.2 mm, and from 1.1 to 2.3 mm in width.

Half Length: Mean values for half length for volutions one through eight are: .08/3, .20/3, .35/3, .60/3, 1.03/3, 1.68/3, 2.78/1, and 3.69/1 mm.

Radius Vector: Mean radius vectors are: .07/3, .10/3, .15/3, .22/3, .34/3, .58/3, .69/1, and 1.01/1 mm respectively for the first through eighth volutions.

Wall: The spirotheca is composed of tectum and a fine-textured keriotheca. A thick epitheca occurs above the tectum in the first three volutions, becoming much less so in the outer volutions. Protheca thickness increases regularly with mean values for the first through eighth volutions of: 9.0/3, 12.1/3, 16.9/3, 27.0/3, 43.1/3, 48.6/3, 51.7/1, and 71.5/1 microns.

Chomata: Rudimentary chomata occur on the first three volutions and are continuous with the heavy epithecal deposits on these volutions. Pseudochomata irregularly occur as thickenings at the base of the septal loops adjacent to the tunnel in the succeeding 1 to 1.5 volutions.

Axial Deposits: Secondary deposits may occur in the axial region of the shell in all but the last two volutions. When present, they are confined to a narrow zone along the axis and are interrupted with local concentrations at the polar region of each volution.

Tunnel: The tunnel is narrow and well defined in the inner volutions, where it expands evenly along an irregular path. Mean values for tunnel width for volutions one through four are: .04/3, .06/3, .11/3, and .21/2 mm.

Septa: Folding of the septa is high, narrow, and rather regular throughout the test. Salients frequently reach the succeeding chamber. Sides of individual arches are more commonly parallel than convex. Arches may be filled with secondary deposits in the inner volutions.

Form Ratio: Average values of form ratio for volutions one through eight are: 1.17/3, 2.03/3, 2.35/3, 2.77/3, 3.01/3, 2.94/3, 4.04/1, and 3.39/1.

Tightness of Spire: The juvenarium is much more tightly coiled than the remainder of the shell, and expands regularly. Expansion increases abruptly by the third or fourth volution. Mean values for percent increase of each succeeding volution are: 50.8/3, 46.8/3, 46.9/3, 57.9/3, 68.4/3, 44.4/1, and 58.0/1.

Proloculus: The initial chamber is small with mean values for the maximum and minimum outside diameter of 86.0 and 75.0 microns.

Discussion

The tightly coiled juvenarium and elongate form of the shell together make this a very distinctive form of *Schwagerina*. Unfortunately, too few specimens were found to formally designate a species.

Occurrence and Material

Schwagerina sp. B occurs in sample RC-23 of Zone D from the lower part of the Limestone Member.

This description is based on three axial sections.

Catalogue Numbers

UA2195 through UA2197.

Table 22. Regression Analysis for *Schwagerina* sp. B

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	20	20	20	20
$\bar{X}_{RX}$	.913	.306	.306	29.665
$\bar{X}_{RY}$	.306	.913	29.665	.306
s_{RX}	.976	.271	.271	19.094
s_{RY}	.271	.976	19.094	.271
r	.982	.982	.935	.935
K	.273	3.537	65.843	.013
$S.E._K$	.012	.159	5.913	.001
b	.057	- .168	9.540	- .088
$S.E._{est.}$	.052	.188	6.984	.099

Schwagerina sp. C

Plate 6, figs. 9-12

Table 23

Diagnosis

Shape: The test is fusiform to subcylindrical with broadly rounded poles. The axis of coiling is straight or irregularly arched.

Size: Individuals of 6.5 to 7 volutions range in length from about 4.5 to 6 mm and in width from 1.5 to 1.9 mm.

Half Length: Mean values of half length for volutions one through seven are: .13/3, .29/3, .52/3, .82/3, .1.25/3, 2.02/3, and 2.91/2 mm respectively.

Radius Vector: The average radius vectors for the first through seventh volutions are: .09/3, .13/3, .21/3, .32/3, .45/3, .60/3, and .92/2 mm.

Wall: The spirotheca is composed of tectum and a fine-textured keriotheca. The epitheca is light to absent. The protheca is thin but increases abruptly in the last volution. Mean values for protheca thickness are: 14.1/3, 15.6/3, 23.5/3, 26.3/3, 31.2/3, 38.3/3, and 72.9/2 microns respectively.

Chomata: Low chomata are present on the proloculus and regularly occur on the first three volutions. Pseudochomata occur irregularly on the succeeding two volutions as secondary thickenings of the base of septa adjacent to the tunnel. Secondary deposits sometimes occur in an arch above the tunnel continuous with pseudochomata.

Axial Deposits: Axial filling is massive and occurs in all specimens. The last one or two volutions generally lack these deposits.

Tunnel: The tunnel is narrow and easily discernable in the inner volutions, where it is bordered by chomata and pseudochomata. The path is straight to slightly irregular. Mean values of tunnel width for the proloculus through the third volution are: .03/2, .05/3, .09/3, and .18/2 mm.

Septa: Fluting is strong and regular. Arches frequently reach the base of the succeeding chamber. Individual arches commonly are narrow with sub-parallel sides. The apices often appear stretched or extended in the outer volutions. Septal loops are generally filled with secondary deposits in the volutions of the juvenarium.

Form Ratio: Mean values for form ratio for volutions one through seven are: 1.43/3, 2.21/3, 2.43/3, 2.55/3, 2.78/3, 3.37/3, and 3.14/2.

Tightness of Spire: The shell is more tightly coiled in the juvenarium and expands irregularly. Mean values for percent increase of each succeeding volution are: 50.9/3, 60.3/3, 51.1/3, 40.7/3, 33.1/3, and 46.1/2.

Table 23. Regression Analysis for *Schwagerina* sp. C

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	20	20	20	20
$\bar{X}_{RX}$	1.045	.362	.362	26.640
$\bar{X}_{RY}$	.362	1.045	29.640	.362
s_{RX}	.917	.263	.263	17.462
s_{RY}	.263	.917	17.462	.263
r	.989	.989	.938	.938
K	.284	3.446	62.198	.014
$S.E._K$	.010	.120	5.410	.001
b	.065	- .203	7.125	- .057
$S.E._{est.}$	.040	.138	6.212	.094

Proloculus: The proloculus is small with mean values of the maximum and minimum outside diameter of 126.9 and 108.9 microns in three specimens.

Discussion

The massive axial filling and highly fluted septa are characteristic of several Artinskian forms of this genus. *Schwagerina* sp. C does not closely resembly any described species known to the writer.

Occurrence and Material

Schwagerina sp. C occurs in the lower part of the Limestone Member. The apparent range of this species coincides with the limits of Zone E.

This description is based on three axial and four oblique sections.

Catalogue Numbers

UA2198 through UA2204.

Schwagerina rainyensis Petocz, n. sp.

Plate 6, figs. 1-8

Tables 24 and 25

Diagnosis

Shape: Most specimens are subelliptical and extended, but several individuals are subcylindrical with broadly rounded to bluntly pointed poles. The axis of coiling is straight.

Size: Individual of 7 to 7.5 volutions range from 7.4 to 10.6 mm in length and from 1.7 to 2.9 mm in width. Accurate measurement of outer volutions were difficult due to erosion of the specimens.

Number of Volutions: Specimens wich are considered mature possess 6.5 to 7.5 volutions.

Half Length: The mean half lengths for the first through seventh volutions are: .25/6, .51/6, .84/7, 1.40/6, 2.48/7, 3.66/7, and 4.42/5 mm.

Radius Vector: Mean values for radius vector for volutions one through six are: .14/7, .22/7, .31/7, .44/7, .66/7, and 1.01/7 mm respectively.

Wall: The spirotheca is composed of tectum and a moderately fine-textured keriotheca and is of uniform thickness throughout the shell. Wall structure was difficult to observe in several specimens due to poor preservation.

The epitheca is thin to absent. The mean values for protheca thickness for the first through the sixth volutions are: 17.8/6, 23.8/7, 28.1/7, 39.2/6, 53.8/7, and 73.3/6 microns.

Chomata: Chomata are not present in this species. Poorly developed pseudochomata are present on the inner volutions as secondary thickenings on septa adjacent to the tunnel. These are difficult to recognize as all septal loops along the midplane of the inner volutions are filled with dense secondary deposits.

Axial Deposits: Dense secondary deposits occur along the axis of coiling and are particularly extensive in the first five volutions. Axial deposits are present in the outer volutions but are more localized as coatings on the intensely fluted septa.

Tunnel: The tunnel is very narrow and low, less than one-half the chamber height in the available sagittal section of the species. The tunnel path is slightly irregular where it can be observed in the volutions bordered by pseudochomata. The path may be obscured by fluted septa in the outer volutions. Mean values for tunnel width in the first through third volutions are: .08/4, .11/4, and .09/3 mm.

Septa: The septa are regularly and intensely fluted from pole to pole. Septa are rather thick and are folded into high narrow arches which commonly reach the base of succeeding volutions. Septal arches are thickened at their apex and may be partially or entirely filled with secondary deposits, particularly in the inner volutions. Poorly developed phrenothecae occur but are generally rare to absent. No cuniculi were observed. Septal counts for volutions three through seven are: 24, 28, 32, 42, and 42.

Form Ratio: Mean values for form ratio for the first through sixth volutions are: 1.81/6, 2.42/6, 2.75/7, 3.17/6, 3.69/7, and 3.56/7.

Tightness of Spire: The juvenarium is more tightly coiled than the rest of the shell. Expansion is fairly regular with mean values for percent increase of succeeding volutions of: 51.1/7, 42.4/7, 43.8/7, 50.3/7, and 52.5/7.

Proloculus: The average maximum and minimum diameters for the initial chamber are 196.6/7 and 177.7/4 microns.

Discussion

Schwagerina rainyensis n. sp. is similar in shape and wall structure to some forms of *S. hyperborea* (Salter) which occur in similar horizons. However, these two species differ abruptly in many other characters. I do not know of any other species with which it might be confused.

Table 24. Regression Analysis for *Schwagerina rainyensis*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	38	38	38	38
$\bar{X}_{RX}$	1.568	.482	.482	39.945
$\bar{X}_{RY}$	.482	1.568	39.945	.482
s_{RX}	1.243	.312	.312	24.235
s_{RY}	.312	1.243	24.235	.312
r	.960	.960	.897	.897
K	.241	3.821	69.558	.012
$S.E._K$	.012	.185	5.727	.001
b	.103	- .272	6.436	.020
$S.E._{est.}$	.088	.352	10.881	.140

Volution	HL 1	2	3	4	5	6	7	8
N	6	6	7	6	7	7	5	1
Max. Value	.308	.748	1.191	1.732	3.572	5.399	5.241	5.153
Min. Value	.167	.344	.597	.886	1.414	2.145	3.303	5.153
$\bar{X}$	.248	.512	.844	1.397	2.478	3.661	4.420	-
S	.053	.138	.196	.340	.857	1.125	.991	-
C.V.	21.1	26.9	23.2	24.3	34.6	30.7	22.4	-
S.E.$_{\bar{X}}$	.021	.056	.074	.139	.324	.425	.443	-

Volution	RV 1	2	3	4	5	6	7	8
N	7	7	7	7	7	7	1	1
Max. Value	.166	.249	.368	.558	.777	1.226	1.128	1.629
Min. Value	.117	.158	.227	.336	.506	.744	1.128	1.629
$\bar{X}$	.142	.215	.306	.440	.660	1.010	-	-
S	.018	.032	.046	.072	.093	.182	-	-
C.V.	12.7	15.0	15.1	16.4	14.1	18.0	-	-
S.E.$_{\bar{X}}$	.007	.012	.017	.027	.035	.069	-	-

Volution	Pro.Min.	Pro.Max.
N	4	7
Max. Value	215.6	227.7
Min. Value	138.6	160.6
$\bar{X}$	177.7	196.6
S	37.1	28.1
C.V.	20.9	14.3
S.E.$_{\bar{X}}$	18.6	10.6

Table 25, Part 1. Observed Variation in *Schwagerina rainyensis*

Volution	FR 1	2	3	4	5	6	7	8
N	6	6	7	6	7	7	1	1
Max. Value	2.62	3.06	3.38	4.19	5.42	4.40	3.00	3.16
Min. Value	1.40	2.11	2.13	2.64	2.59	2.88	3.00	3.16
$\bar{X}$	1.81	2.42	2.75	3.17	3.69	3.56	-	-
S	.44	.45	.42	.56	1.00	.54	-	-
C.V.	24.4	18.5	15.4	17.5	27.2	15.1	-	-
S.E.$_{\bar{X}}$	.18	.18	.16	.23	.38	.20	-	-

Volution	PT	1	2	3	4	5	6	7
N		6	7	7	6	7	6	1
Max. Value		26.4	34.7	37.4	53.9	75.2	106.8	87.5
Min. Value		12.7	17.1	20.9	30.3	39.6	46.8	87.5
$\bar{X}$		17.8	23.8	28.1	39.2	53.8	73.3	-
S		5.5	6.9	6.6	8.7	13.8	22.6	-
C.V.		31.0	29.1	23.4	22.2	25.6	30.9	-
S.E.$_{\bar{X}}$		2.3	2.6	2.5	3.6	5.2	9.2	-

Volution	TW	0	1	2	3	4
N			4	4	3	1
Max. Value			.082	.193	.140	.302
Min. Value			.065	.065	.031	.302
$\bar{X}$			.075	.108	.090	-
S			.008	.058	.055	-
C.V.			10.4	54.0	61.2	-
S.E.$_{\bar{X}}$			.004	.029	.032	-

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7	7-8
N		7	7	7	7	7	1	1
Max. Value		65.6	51.0	51.4	60.8	73.2	51.6	44.4
Min. Value		32.8	34.2	34.5	39.2	36.2	51.6	44.4
$\bar{X}$		51.1	42.4	43.8	50.3	52.5	-	-
S		12.8	5.4	6.0	6.5	11.3	-	-
C.V.		25.0	12.8	13.7	12.9	21.5	-	-
S.E.$_{\bar{X}}$		4.8	2.1	2.3	2.5	4.3	-	-

Table 25, Part 2. Observed Variation in Schwagerina rainyensis

Occurrence and Material

Schwagerina rainyensis n. sp. occurs in Zone F of the Limestone Member in samples WRM-2, WRM-6, WRM-7, and WRM-9.

This description is based on eight axial, one sagittal, and seven oblique sections.

Catalogue Numbers

Holotype, UA2206; paratypes, UA2205, and UA2207 through UA2217.

Schwagerina mankomenensis Petocz, n. sp.

Plate 7, figs. 1-9

Tables 26 and 27

Diagnosis

Shape: Specimens may be elongate fusiform but are more commonly subcylindrical with broadly rounded to bluntly pointed poles. The axis of coiling is straight or irregularly arched.

Size: Mature individuals of six and a half to seven volutions range from 8.0 to 10.6 mm in length, and from 2.0 to 2.2 mm in width.

Number of Volutions: All mature individuals have at least six volutions, and most possess 6.5 or 7 volutions.

Half Length: Mean values of half length for the first through the seventh volutions are: .20/8, .44/8, .85/8, 1.42/8, 2.45/8, 3.84/6, and 4.95/4 mm.

Radius Vector: The mean radius vectors for volutions one through seven are: .12/8, .19/8, .29/8, .44/8, .66/8, .94/6, and 1.21/2 mm respectively.

Wall: The spirotheca is composed of a thin tectum and a finely textured keriotheca. Wall structure is more generally diffuse and difficult to discern. Light epithecal deposits are uncommonly present on the tectum. The protheca is moderately thick and may reach 106 microns in the outer volution. Mean values of protheca thickness from the first through the sixth volutions are: 14.8/8, 20.7/8, 38.2/8, 44.7/8, 56.3/8, and 73.5/6 microns.

Chomata: Rudimentary chomata are present on the proloculus and volutions of the juvenarium in most specimens. Poorly developed pseudochomata occur irregularly in succeeding volutions but are absent on the last two volutions of the test. Secondary deposits may occur in an arch above the tunnel in the inner volutions.

Axial Deposits: Axial deposits occur in the volutions of the juvenarium but may be more extensive in some specimens (Plate 7, fig. 1). Considerable variation exists in this character.

Tunnel: The tunnel is narrow in the inner volutions but may increase to 1/6 the length of the test in the outer volutions of some specimens. The tunnel height is low, about one-half that of the chambers, along which it follows a straight to slightly irregular path. Mean values of tunnel width from the proloculus through the fifth volution are: .04/8, .06/8, .12/8, .24/4, .34/3, and .61/2 mm.

Septa: The septa are strongly and somewhat irregularly folded throughout the test. Septal arches tend to decrease in height in the vicinity of the midplane. The form of the arches is generally narrow or rounded with semi-parallel sides. Cuniculi were not observed. Septal counts for two specimens for volutions one through five are: 13, 18.5, 22, 25.5, and 33.

Form Ratio: The calculated mean values of form ratio for the first through seventh volutions are: 1.65/8, 2.40/8, 3.01/8, 3.30/8, 3.73/8, 4.08/6, and 4.30/2.

Tightness of Spire: The test is evenly coiled and expands regularly until about the fifth volution, when the percent increase drops abruptly, giving the shell a narrower profile. Mean values for percent increase of succeeding volutions are: 57.5/8, 55.0/8, 52.9/8, 51.8/8, 47.5/6, and 40.0/2.

Proloculus: The initial chamber is of a small to medium size with mean values of the maximum and minimum outside diameters of 165.4/8 and 147.3/8 microns.

Discussion

Schwagerina mankomenensis n. sp. shows some similarities in shell construction to *S. jenkinsi* Thorsteinsson (Harker and Thorsteinsson, 1960, p. 25-26) and Ross (1967) but is much smaller, has a thinner protheca, and more extensive axial deposits. *S. juresanensis* (Rauser-Chernousova) (1940, p. 91-92) from Lower Artinskian rocks in the southern Urals agrees closely with *S. mankomenensis* in most measured parameters. *S. juresanensis* has more elongated, spindle-shaped inner volutions and axial deposits occurring only in the juvenarium.

S. mankomenensis n. sp., *S. juresanensis* (Rauser-Chernousova), *S. hyperborea* (Salter), and *S. jenkinsi* Thorsteinsson are all elongate species of *Schwagerina* with similar evolutionary histories. Their occurrence in the Arctic faunal realm suggests a diversion from a common root stock that probably occurred in early to middle Artinskian time.

Table 26. Regression Analysis for <u>Schwagerina mankomenensis</u>

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	47	47	47	47
$\bar{X}_{RX}$	1.521	.435	.435	41.370
$\bar{X}_{RY}$	.435	1.521	41.370	.435
s_{RX}	1.377	.306	.306	22.868
s_{RY}	.306	1.377	22.868	.306
r	.974	.974	.915	.915
K	.217	4.381	68.367	.012
$S.E._K$	.008	.151	4.487	.001
b	.105	- .384	11.648	- .072
$S.E._{est.}$	.070	.314	9.316	.125

Volution	HL 1	2	3	4	5	6	7
N	8	8	8	8	8	6	4
Max. Value	.246	.613	1.099	1.725	3.083	4.982	5.504
Min. Value	.131	.361	.686	1.240	1.893	2.670	4.346
$\bar{X}$	.195	.442	.854	1.424	2.454	3.837	4.952
S	.045	.080	.132	.157	.380	.870	.479
C.V.	22.9	18.0	15.4	11.0	15.5	22.7	9.7
S.E.$_{\bar{X}}$	.016	.028	.047	.055	.134	.355	.240

Volution	RV 1	2	3	4	5	6	7
N	8	8	8	8	8	6	2
Max. Value	.153	.217	.328	.522	.748	1.086	1.307
Min. Value	.085	.134	.226	.350	.541	.798	1.113
$\bar{X}$	.118	.185	.286	.438	.662	.935	1.210
S	.020	.027	.034	.060	.081	.118	.137
C.V.	17.3	14.5	11.9	13.7	12.3	12.7	11.3
S.E.$_{\bar{X}}$	.007	.010	.012	.021	.029	.048	.097

Volution	Pro.Min.	Pro.Max.
N	8	8
Max. Value	162.8	194.2
Min. Value	114.4	143.6
$\bar{X}$	147.3	165.4
S	18.8	16.8
C.V.	12.8	10.1
S.E.$_{\bar{X}}$	6.6	5.9

Table 27, Part 1. Observed Variation in <u>Schwagerina mankomenensis</u>

Volution	FR 1	2	3	4	5	6	7
N	8	8	8	8	8	6	2
Max. Value	1.88	3.09	3.72	4.41	4.74	5.28	4.39
Min. Value	1.08	1.94	2.38	2.56	3.17	3.22	4.21
$\bar{X}$	1.65	2.40	3.01	3.30	3.73	4.08	4.30
S	.26	.40	.54	.59	.59	.70	.13
C.V.	15.7	16.8	18.0	17.9	15.7	17.1	3.0
S.E.$_{\bar{X}}$	.09	.14	.19	.21	.21	.29	.09

Volution	PT 1	2	3	4	5	6	7
N	8	8	8	8	8	6	1
Max. Value	19.8	27.0	46.2	54.5	67.7	102.2	105.7
Min. Value	11.0	17.1	26.4	34.7	38.5	63.3	105.7
$\bar{X}$	14.8	20.7	38.2	44.7	56.3	73.5	-
S	2.7	3.6	6.6	7.2	11.1	14.4	-
C.V.	18.2	17.3	17.4	16.2	19.7	19.5	-
S.E.$_{\bar{X}}$	1.0	1.3	2.3	2.6	3.9	5.9	-

Volution	TW 0	1	2	3	4	5
N	8	8	8	4	3	2
Max. Value	.038	.069	.140	.370	.381	.663
Min. Value	.032	.042	.097	.139	.286	.565
$\bar{X}$	.035	.057	.118	.237	.338	.614
S	.002	.009	.030	.097	.048	.069
C.V.	6.0	16.1	25.7	40.9	14.2	11.3
S.E.$_{\bar{X}}$	.001	.003	.011	.048	.028	.049

Volution	TS 1-2	2-3	3-4	4-5	5-6	6-7
N	8	8	8	8	6	2
Max. Value	71.9	72.9	68.5	76.0	59.2	39.4
Min. Value	41.7	41.3	40.1	41.0	42.8	38.5
$\bar{X}$	57.5	55.0	52.9	51.8	47.5	39.0
S	9.6	11.4	8.9	11.9	5.9	.6
C.V.	16.6	20.8	16.9	23.0	12.5	1.6
S.E.$_{\bar{X}}$	3.4	4.0	3.2	4.2	2.4	.5

Table 27, Part 2. Observed Variation in *Schwagerina mankomenensis*

Occurrence and Material

Schwagerina mankomenensis n. sp. is found in Zone F of the Limestone Member where it occurs in samples WRM-3, WRM-3.5, WRM-4.5, and WRM-8.

This description is based on eight axial, two sagittal and two oblique sections.

Catalogue Numbers

Holotype, UA2224; paratypes, UA2218 through UA2223, and UA2225 through UA2229.

Schwagerina hyperborea (Salter)

Plate 7, figs. 10-14; Plate 8, figs. 1-4 and 8

Tables 28 and 29

Fusulina hyperborea Salter, 1855, p. 380, Plate 36, figs. 1-3.

Schwagerina hyperborea (Salter), Thorsteinsson, 1960, p. 26-27, Plate 6, figs. 1-6; Plate 7, figs. 1-3.

Schwagerina hyperborea (Salter), Ross, 1967, p. 721-722, Plate 84, figs. 15-18.

Diagnosis

Shape: The shell may be elongate fusiform but more commonly is subcyclindrical with broadly rounded poles. The axis of coiling is straight to broadly arching. Most specimens are slightly constricted along the midplane in the vicinity of the tunnel.

Size: The test is large and specimens of 7 to 7.5 volutions range in length from about 8.9 to 13.2 mm, and in width from 3.1 to 3.5 mm.

Number of Volutions: All specimens examined were considered mature individuals and possessed at least six volutions, with most specimens having 7 to 7.5 volutions.

Half Length: Mean half lengths for the first through seventh volutions are: .20/9, .45/9, .81/9, 1.39/7, 2.53/9, 4.00/9, and 4.96/6 mm.

Radius Vector: Mean values for radius vector for volutions 1 through 7.5 are: .11/9, .17/9, .28/9, .43/9, .68/9, 1.04/9, 1.45/6, and 1.67/2 mm respectively.

Wall: The spirotheca is composed of tectum and a comparatively fine-textured keriotheca. Alveoli are rod-shaped and closely spaced, but appear diffuse. Very light epithecal deposits occur on the tectum in the inner volutions. These deposits are almost non-existent on the last chambers of the test. The protheca increases considerably in thickness from the first through the last (7.5) volutions with mean values of: 16.0/9, 21.5/9, 30.7/8, 41.6/9, 59.4/9, 86.0/9, 97.9/4, and 118.1/2 microns respectively.

Chomata: True chomata were not recognized in any of the study specimens. Well developed pseudochomata are present as secondary thickenings of septa adjacent to the tunnel path on the first three or four volutions. These may or may not occur on the outer volutions. Chomata-like deposits are present on the proloculus, but appear to be local thickenings continuous with secondary deposits which encompass the initial chamber.

Axial Deposits: Heavy axial deposits are present without exception in the inner four to five volutions of the shell.

Tunnel: The tunnel path is slightly irregular where it is distinguished by bordering pseudochomata. Tunnel height is quite low, less than one-half chamber height in all volutions. The width increases markedly in the outer volutions with the following mean values for the proloculus through the sixth volution: .04/8, .07/9, .10/8, .15/5, .35/2, .36/1, and .76/2 mm.

Septa: The septa are fairly regularly and intensely fluted from pole to pole, with salients commonly touching the base of succeeding volutions. The folding generally decreases somewhat in height in the vicinity of the tunnel. Septa in the outer volutions may retain their height and cross the tunnel path in broad arches. Septal loops commonly are partially or entirely filled with secondary deposits, particularly in the inner volutions. Low, narrow cuniculi were observed in only one specimen (Plate 8, fig. 8) but are normally absent in this species. Mean septal counts for the first through sixth volutions are: 11/2, 19/3, 23.7/3, 23.3/3, 26/3, and 31/3.

Form Ratio: Much variability exists in the computed form ratios due to the variation in the fusiform to subcylindrical profile of the test. Mean values of the first through seventh volutions are: 1.79/9, 2.55/9, 2.90/9, 3.25/7, 3.72/9, 3.85/9, and 3.44/6.

Tightness of Spire: The test is more tightly coiled in the inner 2 to 2.5 volutions. Mean percentage increase of succeeding chambers from volutions 1-2 through 6-7 are: 54.6/9, 59.3/9, 53.7/9, 58.4/9, 53.1/9, and 45.4/6.

Proloculus: The proloculus is variable in size and ranges from 145.8 to 227.2 microns for the maximum outside diameter. Mean values for the maximum and minimum outside diameter are 172.3/9 and 145.5/9 microns.

Discussion

Species of Schwagerina hyperborea (Salter) from the Upper Delta River section are of slightly smaller size than the specimens described by Thorsteinsson (Harker and Thorsteinsson, 1960, p. 26-28), and Ross (1967). The Alaskan fauna contains more stout-subcylindrical forms such as that illustrated by Thorsteinsson (Harker and Thorsteinsson, 1960, Plate 7, fig. 1). All other characteristics agree satisfactorily for this species.

S. juresanensis (Rauser-Chernousova) from Lower Artinskian deposits in the Urals has the same variation in forms as S. hyperborea (Salter), and is similar in other aspects of morphology. The two species differ in size, protheca thickness, and extent of axial deposits. S. vissarionovae (Rauser-Chernousova) also from Lower Artinskian rocks in the Urals, is somehwat similar in size and shape. Parafusulina durhami Thompson and Miller from the Upper Leonard of the Glass Mountains in west Texas is similar in most aspects to S. hyperborea but has regularly formed low cuniculi. S. setum (Dunbar and Skinner) from the

Table 28. Regression Analysis for Schwagerina hyperborea

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	55	55	55	55
$\bar{X}_{RX}$	1.847	.529	.529	47.669
$\bar{X}_{RY}$	.529	1.847	47.669	.529
s_{RX}	1.690	.419	.419	31.934
s_{RY}	.419	1.690	31.934	.419
r	.976	.976	.943	.943
K	.242	3.936	71.863	.012
$S.E._K$	.007	.121	3.494	.001
b	.082	- .234	9.692	- .061
$S.E._{est.}$	.092	.372	10.756	.141

Volution	HL 1	2	3	4	5	6	7	8
N	9	9	9	7	9	9	6	1
Max. Value	.230	.541	1.063	1.722	3.457	5.366	5.671	6.590
Min. Value	.112	.358	.597	.922	1.620	2.880	4.435	6.590
$\bar{X}$	.202	.446	.808	1.387	2.527	3.996	4.961	-
S	.035	.065	.152	.252	.661	.812	.479	-
C.V.	17.5	14.6	18.9	18.2	26.1	20.3	9.7	-
S.E.$_{\bar{X}}$	.012	.022	.051	.095	.220	.271	.196	-

Volution	RV 1	2	3	4	5	6	7	8
N	9	9	9	9	9	9	6	2
Max. Value	.149	.187	.321	.511	.817	1.301	1.780	1.669
Min. Value	.099	.165	.256	.379	.563	.833	1.255	1.668
$\bar{X}$	.114	.174	.278	.428	.677	1.039	1.452	-
S	.015	.008	.023	.046	.081	.149	.175	-
C.V.	13.0	4.6	8.4	10.8	11.9	14.3	12.0	-
S.E.$_{\bar{X}}$	.005	.003	.008	.015	.027	.050	.071	-

Volution	Pro.Min.	Pro.Max.
N	9	9
Max. Value	177.7	227.2
Min. Value	128.2	145.8
$\bar{X}$	145.5	172.3
S	18.9	27.8
C.V.	13.0	16.1
S.E.$_{\bar{X}}$	6.3	9.3

Table 29, Part 1. Observed Variation in <u>Schwagerina</u> <u>hyperborea</u>

Volution	FR 1	2	3	4	5	6	7	8
N	9	9	9	7	9	9	6	1
Max. Value	2.210	2.890	3.720	3.770	4.950	5.070	4.090	3.950
Min. Value	1.130	2.130	2.260	2.000	2.550	3.090	3.010	3.950
$\bar{X}$	1.79	2.55	2.90	3.30	3.72	3.85	3.44	-
S	.34	.28	.47	.69	.82	.61	.42	-
C.V.	19.1	11.1	16.1	21.3	22.0	15.8	12.1	-
S.E.$_{\bar{X}}$	.11	.09	.16	.26	.27	.20	.17	-

Volution	PT 1	2	3	4	5	6	7	8
N	9	9	8	9	9	9	4	2
Max. Value	18.7	31.4	43.5	53.9	103.5	135.9	112.3	127.1
Min. Value	12.7	16.5	23.1	34.1	44.6	59.4	86.9	109.0
$\bar{X}$	16.0	21.5	30.7	41.6	59.4	86.0	97.9	118.1
S	2.1	4.8	7.2	6.4	17.5	25.7	10.6	12.8
C.V.	12.8	22.4	23.4	15.4	29.5	29.9	10.9	10.8
S.E.$_{\bar{X}}$	.7	1.6	2.5	2.1	5.9	8.6	5.3	9.1

Volution	TW 0	1	2	3	4	5	6
N	8	9	8	5	2	1	2
Max. Value	.058	.142	.143	.237	.484	.362	.792
Min. Value	.029	.040	.063	.115	.216	.362	.727
$\bar{X}$	.037	.073	.100	.152	.350	-	.759
S	.009	.028	.028	.048	.190	-	.046
C.V.	25.0	38.9	28.1	31.9	54.1	-	6.1
S.E.$_{\bar{X}}$	.003	.009	.010	.022	.134	-	.033

Volution	TS 1-2	2-3	3-4	4-5	5-6	6-7	7-8
N	9	9	9	9	9	6	2
Max. Value	69.0	71.7	67.2	76.9	66.3	52.6	32.9
Min. Value	22.7	45.3	43.8	38.3	44.9	34.4	17.2
$\bar{X}$	54.6	59.3	53.7	58.4	53.1	45.4	25.1
S	14.6	8.4	7.6	12.2	7.9	6.6	11.1
C.V.	26.7	14.1	14.1	20.8	14.9	14.6	44.3
S.E.$_{\bar{X}}$	4.9	2.8	2.5	4.1	2.6	2.7	7.9

Table 29, Part 2. Observed Variation in <u>Schwagerina hyperborea</u>

Leonard of the Guadalupe Mountains in Texas is similar in construction to S. hyperborea but has more volutions and is much larger. S. jenkinsi Thorsteinsson from the upper part of the Belcher Channel Formation in the Canadian Archipelago, and from the Tahkandit Formation in northern Yukon Territory, is more tightly coiled and has less dense axial deposits than S. hyperborea.

Occurrence and Material

Schwagerina hyperborea (Salter) occurs in Zone F of the Limestone Member in samples WRM-3, WRM-4.5, and WRM-8. The species also occurs in the Tahkandit Formation in northern Yukon Territory (Ross, 1967), and the upper part of the Belcher Channel Formation in the Canadian Arctic Archipelago (Harker and Thorsteinsson, 1960).

This description is based on seven axial, three sagittal, and two oblique sections.

Catalogue Numbers

UA2231 through UA2243.

Genus Eoparafusulina Coogan, 1960;

Emend. Skinner and Wilde, 1965.

Subgenus Eoparafusulina Ross, 1967

Eoparafusulina mendenhalli Petocz, n. sp.

Plate 8, figs. 5-7; Plate 9, figs. 1-14

Tables 30 and 31

Diagnosis

Shape: The shell is subcylindrical to cylindrical with broadly rounded to truncate poles. Many specimens are inflated in the vicinity of the mid-plane. The test may be stout or narrow with considerable variation between these two extremes. The axis of coiling is straight to broadly arched.

Size: Individuals of seven to eight volutions range in length from 6.6 to 13.5 mm and from 1.7 to 3.0 mm in width.

Number of Volutions: Individuals that were considered mature possess at least 6 to 6.5 volutions with some specimens having as many as eight volutions.

Half Length: Mean values of half length for the first through the eighth volution are: .30/61, .60/60, 1.04/55, 1.67/47, 2.59/49, 3.68/39, 5.00/19, and 5.53/6 mm.

Radius Vector: The average radius vectors for volutions one through eight are: .17/61, .25/62, .35/60, .49/58, .66/49, .91/36, 1.13/16, and 1.35/4 mm respectively.

Wall: The spirotheca is composed of tectum and a coarse-textured keriotheca. An alternation of long and short alveoli are common in the outer volutions. The longer alveoli normally show thickened chamber ends, with considerable individual variation in this character. An epitheca is rare to absent on the tectum. The consistency of the spirotheca is normally even, except along the midplane in the immediate tunnel path, where it may show extreme thinning to less than half its thickness outside the tunnel area. Since all individuals do not show this phenomena, there is considerable variation in protheca thickness in all volutions. The mean values for protheca thickness for volutions one through eight are: 16.9/59, 24.6/60, 33.8/57, 45.7/59, 60.1/48, 66.9/32, 83.6/14, and 78.9/3 microns.

Chomata: Rudimentary chomata are irregularly present on the proloculus and first two or three volutions. Pseudochomata are well developed in succeeding volutions. Secondary deposits frequently occur in a broad arch over the tunnel and connect the pseudochomata on either side. Since the tunnel is wide in the outer volutions, the arch may appear as a "false wall" within the volution (Plate 9, fig. 11).

Axial Deposits: Light axial deposits may occur but commonly are in the form of interrupted patches along the axis at the junction of volutions. Several anomalous individuals have more dense axial deposits occurring in the first five volutions. Many specimens are completely free of these deposits.

Tunnel: The tunnel is low, less than half the chamber height, but the height varies considerably in all volutions. The path is straight to irregular and is generally discernable in all but the last volution. The tunnel is very wide with mean values for the proloculus through the sixth volution of: .07/47, .14/54, .25/46, .49/41, .69/49, 1.08/27, and 1.32/11 mm.

Septa: The septa are broadly wavy and irregular with only the lower portion of the septa being folded along the lateral slopes. Fluting appears as small loops less than half the volution height on the lateral slopes. The septa are more intensely folded at the poles. Salients of opposing septa meet and are resorbed in the outer volutions, forming low and narrow cuniculi. Primitive cuniculi are irregularly formed in the inner volutions. Individual arches are sometimes partially or entirely filled with secondary deposits. Septal pores are common. Mean septal counts for the first through seventh volutions are: 10/14, 13.9/14, 16.1/14, 18.6/12, 19.7/9, 25.2/6, and 27/2.

Form Ratio: There are wide differences in computed values of form ratio due to the great amount of variation in the shell profile. Mean values for volutions one through eight are: 1.75/60, 2.39/60, 2.97/54, 3.42/47, 3.82/44, 4.07/32, 4.10/13, and 3.92/3.

Tightness of Spire: The test is evenly coiled and expands regularly until the eighth volution, which shows only a slight increase. The percent increase of succeeding volutions is normally under 50%; computed mean values are: 50.3/61, 41.9/60, 40.2/57, 39.2/49, 37.2/33, 34.6/15, and 28.3/4.

Proloculus: The initial chamber is round to irregular in profile and ranges from 123.2 to 321.8 microns for the maximum outside diameter. Mean values for the maximum and minimum outside diameters are 223.4/62 and 198.8/59 microns respectively.

Discussion

Although I have revised my original designation of this species to *Eoparafusulina* (previously *Monodiexodina*), the concept that these forms are transitional with *Alaskanella* certainly holds true (Petocz, 1967). Ross (1967) revised the identity of *Alaskanella* originally proposed by Skinner and Wilde (1966a), placing it as a junior subjective synonum of *Eoparafusulina*. I independently reached the same conclusion regarding the status of *Alaskanella* as Ross, and therefore need not restate it in this paper.

Eoparafusulina mendenhalli n. sp. is distinguished from E. paralinearis (Thorsteinsson) from the middle part of the Belcher Channel Formation on Grinnell Peninsula, Arctic Archipelago, by its great irregularity of shape, greater number of volutions, much lower tunnel, and larger size of the test. E. laudoni (Skinner and Wilde) from the Tahkandit Limestone (?) in northeastern Alaska and E. yukonensis (Skinner and Wilde) from the Nation River Formation (?) in northwestern Yukon Territory (Skinner and Wilde, 1966) are much smaller, have a thinner spirotheca, smaller proloculus, and evidentally a more rare development of cuniculi. It should be pointed out that the two latter species were identified from float. Their correct stratigraphic position is therefore in doubt.

E. langsonensis (Saurin) from the Sakamotozawa Formation of the Sakamotazawa-Nagaiwa area, Japan, (Kanmera and Mikami, 1965, p. 288-289) is smaller and narrower for the same number of volutions, has a much smaller proloculus, and probably less well-developed cuniculi than E. mendenhalli. Kanmera and Mikami reported that no cuniculi were observed in E. langsonensis. E. thompsoni Skinner and Wilde from the upper part of the McCloud Limestone in northern California (Skinner and Wilde, 1965, p. 77) differs in that it has a more tightly coiled juvenarium and a smaller proloculus. E. allisonensis Ross from the Neal Ranch Formation, Texas, (Ross, 1967) is readily distinguished from E. mendenhalli in possessing true chomata in the outer volutions. E. allisonensis also differs in the smaller size of its proloculus and regular path of the tunnel. Unfortunately septal counts were not included in the description of E. allisonensis Ross.

I was able to study the type material of Parafusulina alaskensis Dunbar from the Permian of Kuiu Island, southeastern Alaska, through the courtesy of the American Museum of Natural History. This species is very similar to E. mendenhalli from interior Alaska and should be assigned to the genus Eoparafusulina. It should be qualified, however, that both species are assigned to this genus sensu lato in that they are the largest forms yet described and have more well-developed cuniculi in the outer volutions than other species in this genus (Plate 9, figs. 12 and 13; Plate 10, figs. 8 and 11). Although scattered occurrences of axial deposits are present in some specimens of E. mendenhalli, both species lack the consistent massive axial deposits of the genus Monodiexodina. E. mendenhalli is distinguished from E. alaskensis (Dunbar) by its larger proloculus, irregular axial deposits, and more variation in the test. E. alaskensis is also much elongated in the sixth volution, giving it longer dimensions that E. mendenhalli.

E. mendenhalli is an advanced species of the genus as attested by its mode of cuniculi development, occasional axial filling, and large size of the test. The very primitive cuniculi early in the ontogeny of the shell suggests its lineage to the Alaskanella group of Skinner and Wilde (1966a). It is clearly an ancestral form of the true Monodiexodinas as defined by Sosnina (1956, p. 21-29). Its advanced state of evolution, together with its occurrence with and above species of Schwagerina

Table 30. Regression Analysis for Eoparafusulina mendenhalli

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	294	294	294	294
$\bar{X}_{RX}$	1.522	.449	.449	39.671
$\bar{X}_{RY}$	.449	1.522	39.671	.449
s_{RX}	1.306	.284	.284	22.701
s_{RY}	.284	1.306	22.701	.284
r	.971	.971	.882	.882
K	.211	4.466	70.461	.011
$S.E._K$	.003	.064	2.206	.000
b	.128	- .484	8.019	.012
$S.E._{est.}$	.068	.311	10.729	.134

Volution	HL 1	2	3	4	5	6	7	8
N	61	60	55	47	49	39	19	6
Max. Value	5.350	1.151	2.053	2.906	4.248	5.425	6.380	6.813
Min. Value	.125	.302	.535	.794	1.532	2.148	3.634	3.398
$\overline{X}$	.296	.598	1.040	1.667	2.586	3.678	4.966	5.528
S	.096	.172	.270	.412	.635	.815	.799	1.159
C.V.	32.5	28.9	26.0	24.7	24.6	22.2	16.1	21.0
S.E.$_{\overline{X}}$	.012	.022	.036	.060	.091	.131	.183	.473

Volution	RV 1	2	3	4	5	6	7	8
N	61	62	60	58	49	36	16	4
Max. Value	.284	.434	.546	.758	.913	1.215	1.485	1.509
Min. Value	.089	.145	.212	.297	.423	.600	.810	.995
$\overline{X}$	.168	.252	.354	.487	.656	.909	1.131	1.348
S	.041	.056	.066	.090	.104	.144	.165	.240
C.V.	24.3	22.3	18.7	18.5	15.9	15.9	14.6	17.8
S.E.$_{\overline{X}}$	.005	.007	.009	.012	.015	.024	.041	.120

Volution	Pro. Min.	Pro. Max.
N	59	61
Max. Value	275.0	321.8
Min. Value	122.7	123.2
$\overline{X}$	198.8	223.4
S	39.1	45.5
C.V.	19.7	20.4
S.E.$_{\overline{X}}$	5.1	5.8

Table 31, Part 1. Observed Variation in <u>Eoparafusulina mendenhalli</u>

Volution	FR 1	2	3	4	5	6	7	8
N	60	60	54	47	44	32	13	3
Max. Value	2.94	3.56	4.02	4.62	5.43	5.36	4.91	4.57
Min. Value	.81	1.42	1.95	2.29	2.65	3.14	3.33	3.41
$\overline{X}$	1.75	2.39	2.97	3.42	3.82	4.07	4.10	3.92
S	.43	.48	.48	.59	.67	.58	.51	.59
C.V.	24.6	20.0	16.3	17.1	17.6	14.2	12.4	15.1
S.E.$_{\overline{X}}$	.06	.06	.07	.09	.10	.10	.14	.34

Volution	PT	1	2	3	4	5	6	7	8
N		57	60	57	59	48	32	14	3
Max. Value		44.6	58.9	60.5	82.5	93.5	96.3	100.7	84.2
Min. Value		6.1	11.6	16.0	24.8	36.3	35.2	54.5	72.1
$\bar{X}$		16.9	24.6	33.8	45.7	60.1	66.9	83.6	78.9
S		7.2	10.4	10.7	13.4	13.7	15.1	13.8	6.2
C.V.		42.7	42.2	31.5	29.4	22.8	22.6	16.5	7.8
$S.E._{\bar{X}}$		1.0	1.3	1.4	1.8	2.0	2.7	3.7	3.6

Volution	TW	0	1	2	3	4	5	6
N		47	54	46	41	40	27	11
Max. Value		.154	.330	.570	1.284	1.355	2.003	2.191
Min. Value		.036	.067	.069	.191	.287	.611	.753
$\bar{X}$		.071	.140	.254	.486	.694	1.080	1.316
S		.023	.050	.120	.259	.284	.344	.439
C.V.		32.2	35.4	47.1	53.3	40.9	31.9	33.4
$S.E._{\bar{X}}$		.003	.007	.018	.040	.045	.066	.132

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7	7-8
N		61	60	57	49	33	15	4
Max. Value		83.7	65.6	65.1	72.2	58.5	46.0	44.9
Min. Value		31.3	17.8	11.1	22.8	24.7	24.1	12.9
$\bar{X}$		50.3	41.9	40.2	39.2	37.2	34.6	28.3
S		10.9	9.9	8.6	7.3	8.3	5.7	13.7
C.V.		21.7	21.4	21.4	18.7	22.4	16.5	48.3
$S.E._{\bar{X}}$		1.4	1.2	1.1	1.1	1.5	1.5	6.8

Table 31, Part 2. Observed Variation in Eoparafusulina mendenhalli which have clear affinities for Russian Upper Sakmarian forms, suggests a similar age for this species.

The species is named in honor of Walter C. Mendenhall, U.S. Geological Survey geologist, who contributed greatly to the geology of Alaska and described the type section of the Mankomen Formation.

Occurrence and Material

Eoparafusulina mendenhalli n. sp. occurs abundantly in equivalent samples RC-15 and DR-14 in Zone C. It is also found in samples RC-14, RC-16, and RC-17 of the same zone.

This description is based on 62 axial, 15 sagittal and numerous oblique sections. Many additional axial sections were studied but were not measured.

Catalogue Numbers

Holotype, UA2264; paratypes, UA2244 through UA2263, and UA2265 through UA2374.

Eoparafusulina waddelli Petocz, n. sp.

Plate 10, figs. 1-13

Tables 32 and 33

Diagnosis

Shape: The test is elongate, subcylindrical to cylindrical with broadly rounded poles. The axis of coiling is straight but may be slightly arched in some specimens.

Size: Individuals of six to seven volutions range in length from 5.4 to about 8.5 mm, and from 1.7 to 2.7 mm in width.

Number of Volutions: All mature individual possess at least five volutions but may have as many as seven.

Half Length: The mean values of half length for the first through the seventh volutions are: .23/29, .52/29, .96/28, 1.59/27, 2.55/24, 3.40/14, and 4.09/3 mm.

Radius Vector: The average radius vectors for volutions one through seven are: .15/29, .23/29, .35/28, .52/27, .74/24, .94/16, and 1.22/4 mm respectively.

Wall: The spirotheca is composed of tectum and a coarse keriotheca. Wall structure is rather diffuse in many specimens, particularly in the first five volutions. The wall is of even consistency but may be constricted in the tunnel area to less than half its normal thickness, causing a considerable range of variation in protheca thickness. Mean values for protheca thickness are: 14.4/29, 25.6/29, 42.0/28, 59.0/27, 73.8/22, 80.9/14, and 93.6/2 microns.

Chomata: Rudimentary chomata are usually present on the proloculus and succeeding one or two volutions. Pseudochomata irregularly occur on the remaining volutions, frequently in conjunction with secondary deposits which form a broad arch over the tunnel path. These deposits give the impression of a "false wall" as in Eoparafusulina mendenhalli n. sp.

Axial Deposits: Secondary axial filling is not characteristic of this species. Localized patches uncommonly occur at the poles of volutions. One anomalous individual possessed comparatively dense deposits along the axis of the fifth volution (Plate 10, fig. 10).

Tunnel: The tunnel is low, about one-half the chamber height in all volutions. The tunnel path is straight to irregular but is obscure in outer volutions which lack pseudochomata. The tunnel widens considerably in the outer whorls with mean values for tunnel width for the proloculus through the fifth volution of: .06/25, .12/29, .21/27, .45/27, .78/22, and 1.07/13 mm.

Septa: The septa are moderately and irregularly fluted. Only the lower part of the septa are folded along the lateral slopes and appear as small semi-circles which decrease in height toward the midplane. Fluting is more intense in the polar regions. Salients of opposing folds are resorbed in the outer three to four volutions, forming the low, narrow cuniculi which are characteristic of this genus. Septal pores are abundant and easily recognized in the polar areas. Mean values for septal counts in volutions one through five are: 8/4, 12/4, 15.3/4, 17.3/3, and 19.2/2.

Form Ratio: Mean values of form ratio for volutions one through seven are: 1.59/29, 2.29/29, 2.76/28, 3.12/26, 3.41/24, 3.59/13, and 3.18/2.

Tightness of Spire: There is a general progressive decrease in the percent expansion values for each succeeding volution. The mean values are: 55.9/29, 52.7/28, 47.1/27, 45.1/24, 38.9/16, and 30.8/4.

Proloculus: The proloculus is generally spherical but may be irregular in shape and ranges in size from 138.6 to 319.6 microns in maximum outside diameter. Mean values for the maximum and minimum outside diameters are 210.7 and 181.7 microns in 29 specimens.

Discussion

Eoparafusulina waddelli n. sp. is a more typical form of this genus than *E. mendenhalli*. It is distinguished from the latter species in posessing fewer volutions, shorter length, slightly thicker protheca in the last four volutions, and absence of axial deposits. The cuniculi also appear wider in E. waddelli. E. thompsoni Skinner and Wilde from the McCloud Limestone, northern California, E. langsonensis (Saurin) from the Sakamotozawa Formation in Japan, and E. alaskensis (Dunbar) from Kuiu Island, southeastern Alaska, are all much larger and differ in other modes of construction of the test. E. gracilis (Meek) from the McCloud Limestone is more tightly coiled, has a smaller proloculus, and has axial deposits. E. allisonensis Ross from the Neal Ranch Formation, Texas, has more volutions and more extensive and well developed chomata. E. laudoni (Skinner and Wilde) from the Lower Permian of the Alaska-Yukon border are both more primitive than E. waddelli and are generally smaller with a much thinner spirotheca, possess axial filling, and have poorly developed cuniculi, if any. E. paralinearis (Thorsteinsson) from the Permian of Grinnell Peninsula resembles E. waddelli in size and shape but differs in possessing chomata in all volutions, has a much higher tunnel, and probably a more primitive development of cuniculi. Cuniculi were not reported in this species by Thorsteinsson.

The species is named for Dr. Dwight E. Waddell, Houston, Texas.

Occurrence and Material

Eoparafusulina waddelli n. sp. occurs in samples RC-18 and RC-19 in the upper part of the Alternating Limestone-Shale Member (Zone C) 54

Table 32. Regression Analysis for *Eoparafusulina waddelli*

Selection	RV/HL	HL/RV	PT/RV	RV/PT
N_R	148	148	148	148
$\bar{X}_{RX}$	1.307	.430	.430	44.618
$\bar{X}_{RY}$	.430	1.307	44.618	.430
s_{RX}	1.079	.273	.273	25.610
s_{RY}	.273	1.079	25.610	.273
r	.971	.971	.892	.892
K	.246	3.833	83.546	.010
$S.E._K$	.005	.079	3.509	.000
b	.108	- .339	8.738	.005
$S.E._{est.}$	.066	.260	11.629	.124

Volution	HL 1	2	3	4	5	6	7
N	29	29	28	27	24	14	3
Max. Value	.364	.813	1.637	2.795	4.205	4.477	4.484
Min. Value	.108	.328	.617	.964	1.761	2.736	3.788
$\bar{X}$	.229	.517	.957	1.588	2.545	3.402	4.088
S	.063	.125	.237	.459	.682	.554	.358
C.V.	27.8	24.3	24.8	28.9	26.8	16.3	8.8
$S.E._{\bar{X}}$							

Volution	RV 1	2	3	4	5	6	7
N	29	29	28	27	24	16	4
Max. Value	.205	.344	.494	.730	1.087	1.161	1.383
Min. Value	.096	.154	.227	.343	.498	.706	1.050
$\bar{X}$	.146	.227	.348	.516	.741	.941	1.221
S	.029	.045	.065	.091	.140	.137	.136
C.V.	19.8	19.7	18.7	17.6	19.0	1.45	11.2
$S.E._{\bar{X}}$	.005	.008	.012	.017	.029	.034	.068

Volution	Pro.Min.	Pro.Max.
N	29	29
Max. Value	280.5	319.6
Min. Value	121.0	138.6
$\bar{X}$	187.7	210.7
S	36.1	43.7
C.V.	19.9	20.7
$S.E._{\bar{X}}$	6.7	8.1

Table 33, Part 1. Observed Variation in Eoparafusulina waddelli

Volution	FR 1	2	3	4	5	6	7
N	29	29	28	26	24	13	2
Max. Value	2.42	3.37	4.32	4.82	4.36	4.40	3.28
Min. Value	.76	1.57	1.90	2.42	2.51	2.91	3.07
$\bar{X}$	1.59	2.29	2.76	3.12	3.41	3.59	3.18
S	.41	.43	.51	.55	.47	.45	.15
C.V.	25.8	18.5	18.4	17.7	13.6	12.5	4.7
$S.E._{\bar{X}}$	.08	.08	.10	.11	.10	.12	.11

Volution	PT	1	2	3	4	5	6	7
N		29	29	28	27	22	14	2
Max. Value		22.6	44.6	71.0	81.4	111.2	122.2	106.2
Min. Value		7.2	11.0	22.0	38.0	48.4	55.6	80.9
$\overline{X}$		14.4	25.6	42.0	59.0	73.8	80.9	93.6
S		4.3	9.6	11.6	12.2	13.6	19.3	17.9
C.V.		29.5	37.6	27.5	20.8	18.4	23.9	19.1
S.E.$_{\overline{X}}$		.8	1.8	2.2	2.4	2.9	5.2	12.7

Volution	TW	0	1	2	3	4	5
N		25	29	27	27	22	13
Max. Value		.086	.231	.452	.954	2.054	1.829
Min. Value		.034	.070	.111	.184	.311	.178
$\overline{X}$		.057	.116	.213	.453	.781	1.074
S		.012	.038	.084	.210	.406	.454
C.V.		21.6	33.0	39.2	46.4	52.0	42.3
S.E.$_{\overline{X}}$		.002	.007	.016	.040	.087	.126

Volution	TS	1-2	2-3	3-4	4-5	5-6	6-7
N		29	28	27	24	16	4
Max. Value		70.2	74.3	62.6	54.9	57.2	45.8
Min. Value		41.1	4011	36.3	35.6	12.6	18.0
$\overline{X}$		55.9	52.7	47.1	45.1	38.9	30.8
S		8.7	8.9	6.6	5.5	9.7	12.2
C.V.		15.5	16.8	14.0	12.2	24.8	39.6
S.E.$_{\overline{X}}$		1.6	1.7	1.3	1.1	2.4	6.1

Table 33, Part 2. Observed Variation in Eoparafusulina waddelli feet above the last recorded occurrence of E. mendenhalli n. sp.

This description is based on 29 axial, 4 sagittal, and numerous oblique sections.

Catalogue Numbers

Holotype, UA2381; paratypes, UA2375 through UA2380, and UA2382 through UA2414.

PLATES

Explanation of Plate 1

All figures X10 except as noted

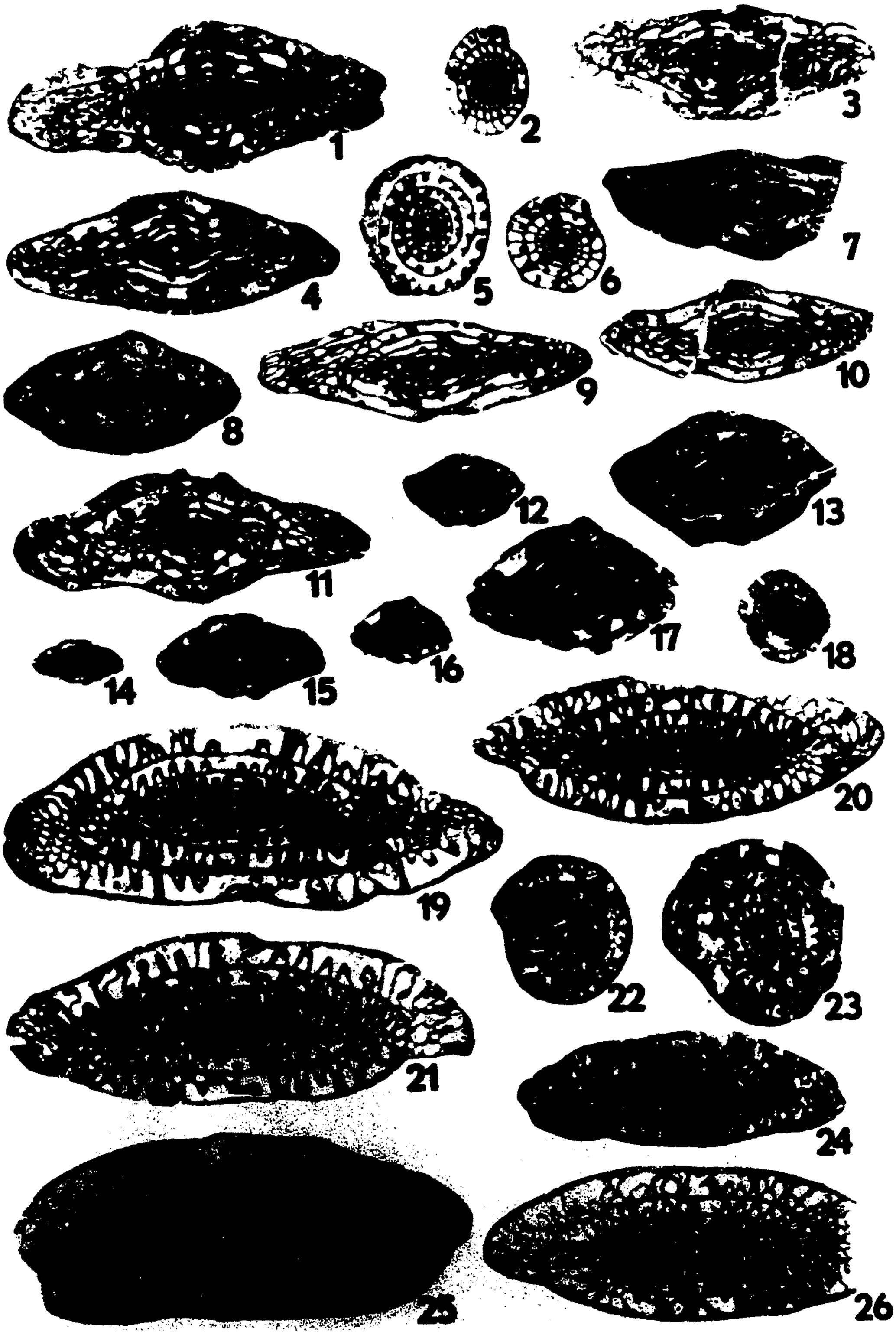
Figs. 1-2: Pseudofusulinella sp. A, from assemblage zone A in the Alternating Limestone-Shale Member. 1, Axial section, UA2000, loc. RC-3; 2, sagittal section, UA2002, loc. RC-3.

Figs. 3-11: Pseudofusulinella valkenburghae Petocz, n. sp., from assemblage zone B in the Alternating Limestone-Shale Member. 3, 4, 7, 8, 10, 11, Paratypes, UA2021, UA2015, UA2013, UA2018, UA2019, UA2028, loc. RC-11; 5, 6, sagittal sections, UA2022, UA2024, loc. RC-11; 9, holotype, UA2014, loc. RC-11.

Figs. 12-18: Pseudofusulinella cf. P. parvula Skinner and Wilde, from assemblage zone B in the Alternating Limestone-Shale Member. 12, 14, 16, Axial sections, UA2029, UA2030, UA2031, loc. RC-13; 13, 15, 17, enlargements of figs. 12, 14, and 16 respectively, X20.

Figs. 19-26: Schwagerina pseudokaragasensis Petocz, n. sp., from assemblage zone B in the Alternating Limestone-Shale Member. 19, 20, 24, 25, 26, Paratypes, UA2054, UA2051, UA2057, UA2052, UA2053, loc. RC-9; 21, holotype, UA2056, loc. RC-9; 22, 23, sagittal sections, UA2058, UA2059, loc. RC-9.

PLATE 1



Explanation of Plate 2

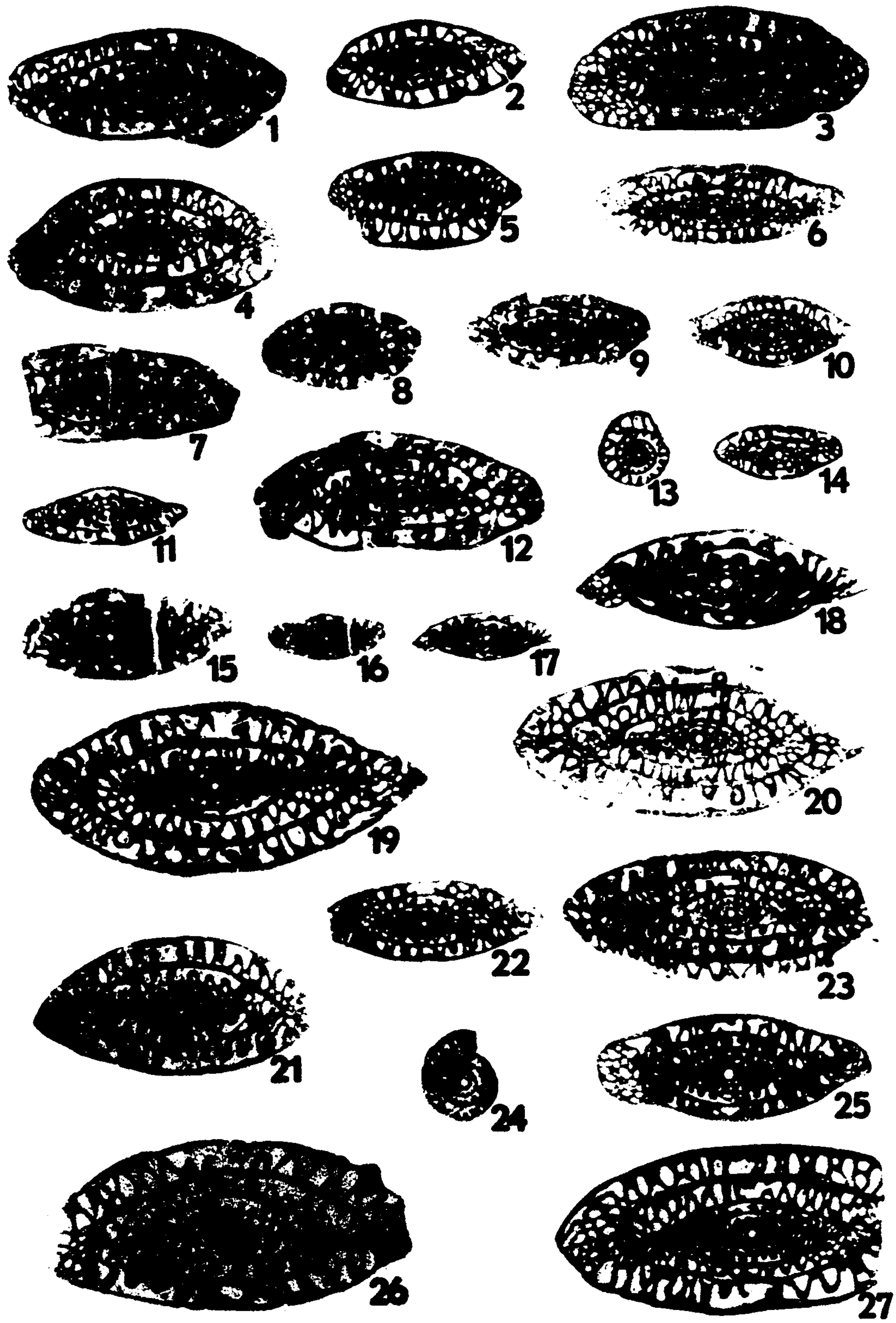
All figures X10 except as noted

Figs. 1-5: Schwagerina sp. A, from assemblage zone B in the Alternating Limestone-Shale Member. 1-3, 5, Axial sections, UA2065, UA2061, UA2064, UA2062, loc. RC-8; 4, slightly oblique section, UA2067, loc. RC-13.

Figs. 6-18: Schwagerina cf. S. emaciata (Beede), from assemblage zone B in the Alternating Limestone-Shale Member. 6, 10, 17, Axial Sections, UA2043, UA2045, UA2046, loc. RC-17; 18, enlargement of fig. 17, X20; 7, 9, 11, 14, 16, axial sections, UA2038, UA2040, UA2039, UA2035, UA2037, loc. RC-10; 15, enlargement of fig. 16, X20; 8, oblique section, UA2049, loc. RC-10; 12, axial section, UA2041, loc. RC-11; 13, sagittal section, UA2048, loc. RC-11.

Figs. 19-27: Schwagerina rowetti Petocz, n. sp., from assemblage zone C in the Alternating Limestone-Shale Member. 19, Holotype, UA2077, loc. RC-16; 20, 26, paratypes, UA2078, UA2079, loc. DR-14; 21, paratype, UA2076, loc. RC-15; 22, 23, paratypes, UA2072, UA2070, loc. RC-16; 24, sagittal section, UA2080, loc. RC-15; 25, 27, paratypes, UA2074, UA2075, loc. RC-17.

PLATE 2

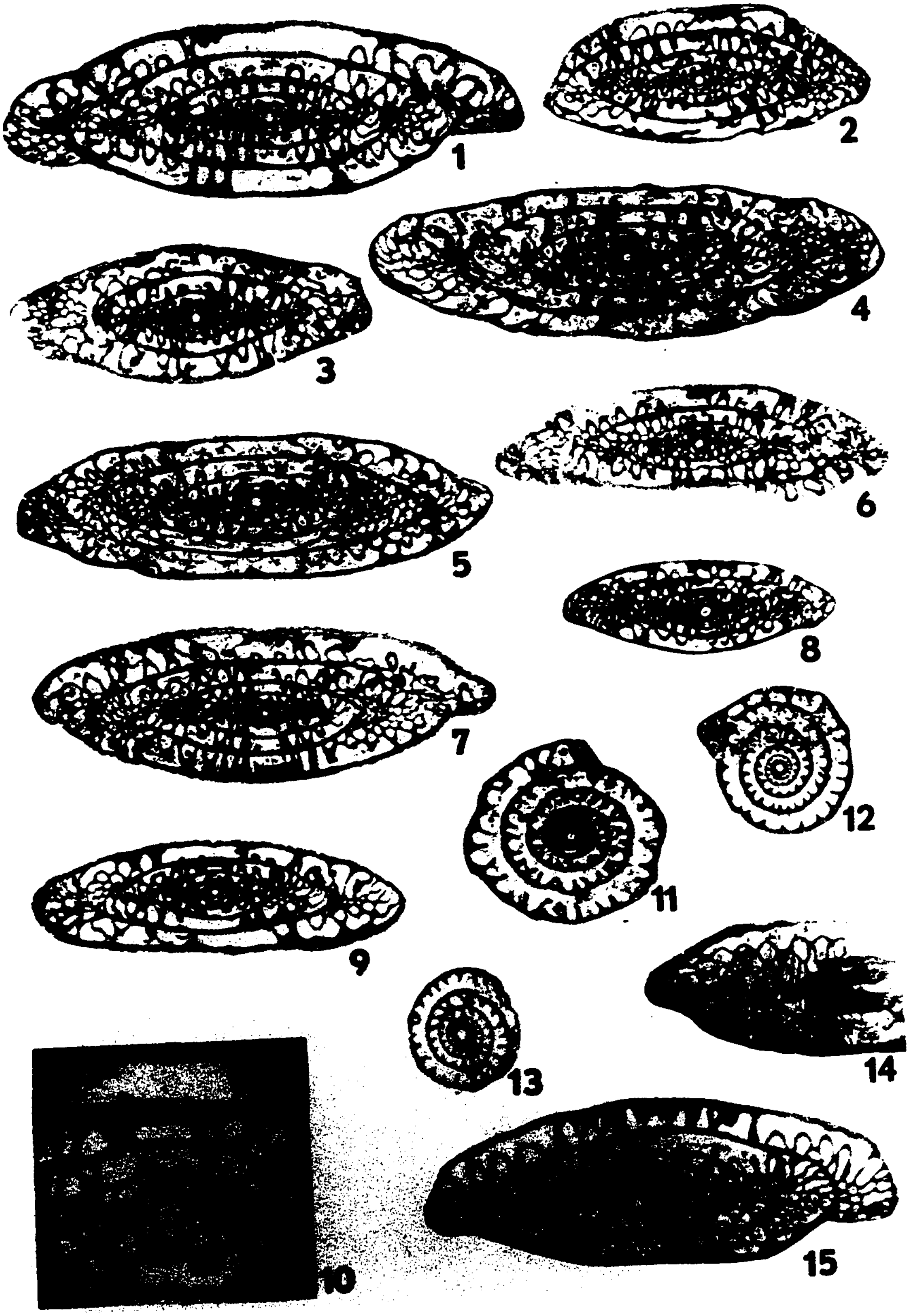


Explanation of Plate 3

All figures X10 except as noted

Figs. 1-15: *Schwagerina whartoni* Petocz, n. sp., from assemblage zones B and C of the Alternating Limestone-Shale Member. 1, Holotype, UA2103, loc. RC-12; 2, 4, 5, 7-9, 15, paratypes, UA2111, UA2113, UA2106, UA2110, UA2102, UA2101, UA2109, loc. RC-12; 3, paratype, UA2095, loc. RC-11; 6, 15, paratypes, UA2116, UA2109, loc. RC-15; 11, sagittal section, UA2121, loc. RC-11; 12, 13, sagittal sections, UA2122, UA2124, loc. RC-12; 10, enlargement of part of fig. 9 showing development of secondary deposits over the tunnel, UA2101, loc. RC-12, X35; 14, oblique section showing septal fluting, UA2126, loc. RC-11.

PLATE 3



Explanation of Plate 4

All figures X10

Figs. 1-7: Schwagerina callosa (Rauser-Chernousova), from assemblage zones B and C of the Alternating Limestone-Shale Member. 1, 3, Axial sections, UA2084, UA2085, loc. RC-13; 2, oblique section, UA2086, loc. RC-15; 4, axial section, UA2093, loc. RC-17; 5, 6, axial sections, UA2089, UA2087, loc. RC-19; 7, sagittal section, UA2090, loc. RC-13.

Figs. 8-13: Schwagerina moffiti Petocz, n. sp., from assemblage zone D in the Alternating Limestone-Shale Member. 8, 9, 11, 13, paratypes, UA2130, UA2128, UA2131, UA2129, loc. RC-20; 12, holotype, UA2132, loc. RC-20; 10, sagittal section, UA2135, loc. RC-20.

PLATE 4

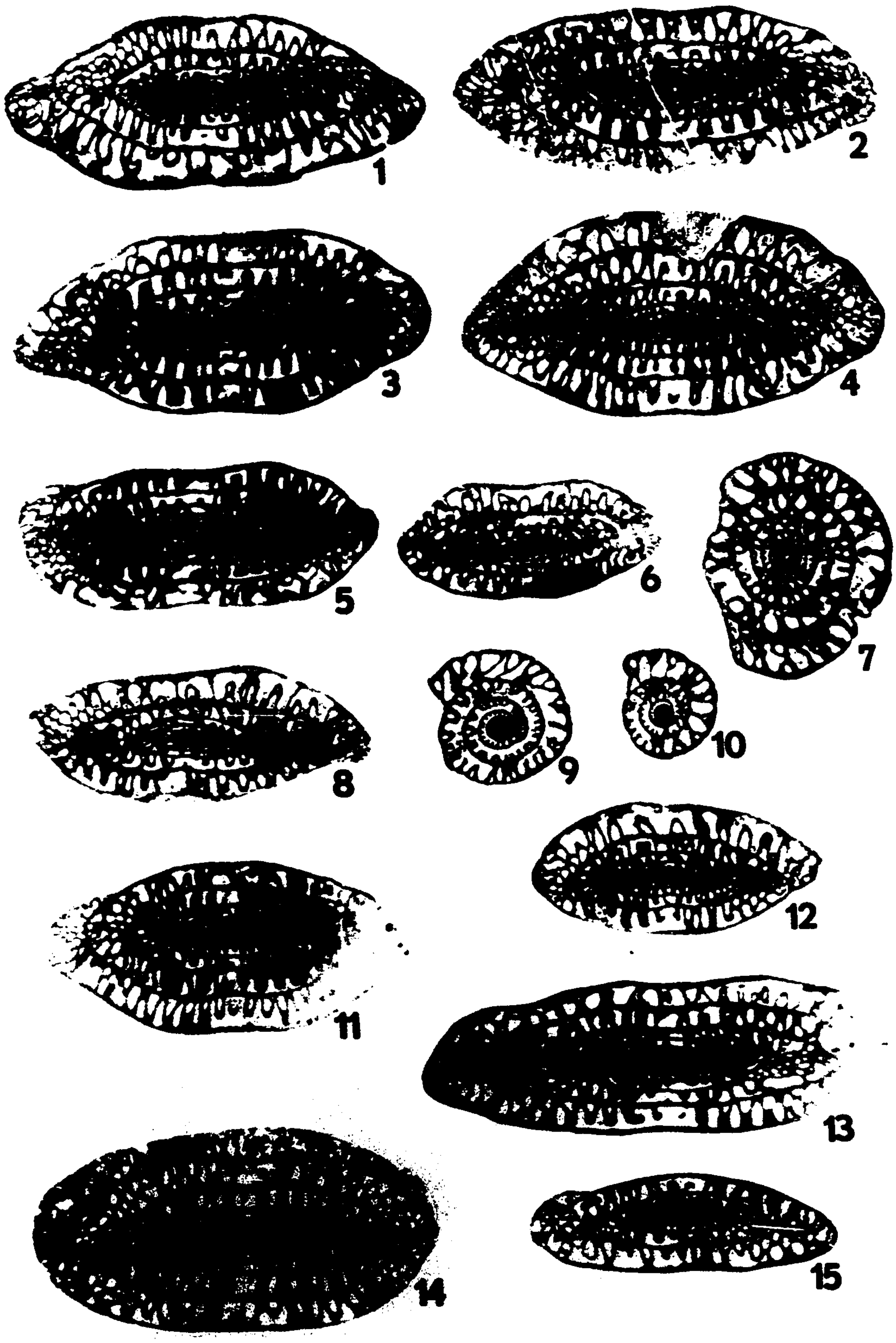
Explanation of Plate 5

All figures X10

Figs. 1-12, 14: *Schwagerina heineri* Petocz, n. sp., from assemblage zone D in the Limestone Member. 1, Holotype, UA2148, loc. RC-22; 2-6, 8, 11, 12, 14, paratypes, UA2145, UA2139, UA2137, UA2143, UA2164, UA2157, UA2138, UA2147, UA2153, loc. RC-22; 7, 9, 10, sagittal sections, UA2175, UA2174, UA2172, loc. RC-22.

Figs. 13, 15: *Schwagerina* sp. B, from assemblage zone D in the Limestone Member. 13, 15, Axial sections, UA2195, UA2197, loc. RC-23.

PLATE 5



Explanation of Plate 6

All figures X10

Figs. 1-8: Schwagerina rainyensis Petocz, n. sp., from assemblage zone F in the Limestone Member. 1, Paratype, UA2205, loc. WRM-6; 2, holotype, UA2206, loc. WRM-7; 3, 5, paratypes, UA2217, UA2212, loc. WRM-2; 6, oblique section showing highly fluted septa, UA2213, loc. WRM-6; 7, 8, paratypes, UA2207, UA2209, loc. WRM-7 and loc. WRM-9 respectively; 4, sagittal section, UA2210, loc. WRM-6.

Figs. 9-12: Schwagerina sp. C, from assemblage zone E in the Limestone Member. 9, 10, 11, Axial section, UA2198, UA2200, UA2199, loc. RC-27; 12, slightly oblique section, UA2202, loc. RC-26.

PLATE 6

Explanation of Plate 7

All figures X10

Figs. 1-9: *Schwagerina mankomenensis* Petocz, n. sp., from assemblage zone F in the Limestone Member. 1, Holotype, UA2224, loc. WRM-4.5; 2, paratype, UA2222, loc. WRM-3.5; 3, 4, 5, 8, paratypes, UA2220, UA2218, UA2219, UA2221, loc. WRM-3; 9, oblique section showing fluted septa, UA2229, loc. WRM-3; 6, 7, sagittal sections, UA2226, UA2227, loc. WRM-3.

Figs. 10-14: *Schwagerina hyperborea* (Salter), from assemblage zone F in the Limestone Member. 10, 13, Sagittal sections, UA2240, UA2239, loc. WRM-3; 11, sagittal section, UA2241, loc. WRM-4.5; 12, 14, axial sections, UA2237, UA2234, loc. WRM-4.5, and loc. WRM-8 respectively.

PLATE 7

Explanation of Plate 8

All figures X10

Figs. 1-4, 8: *Schwagerina hyperborea* (Salter), from assemblage zone F in the Limestone Member. 1, 4, Axial sections, UA2236, UA2231, loc. WRM-4.5; 2, axial section, UA2235, loc. WRM-3; 3, axial section, UA2238, loc. WRM-8; 8, oblique section showing highly fluted septa and low cuniculi, UA2241, loc. WRM-4.5.

Figs. 5-7: *Eoparafusulina mendenhalli* Petocz, n. sp., from assemblage zone C in the Alternating Limestone-Shale Member. 5, Paratype, UA2278, loc. DR-14; 6, 7, paratypes, UA2245, UA2244, loc. RC-15.

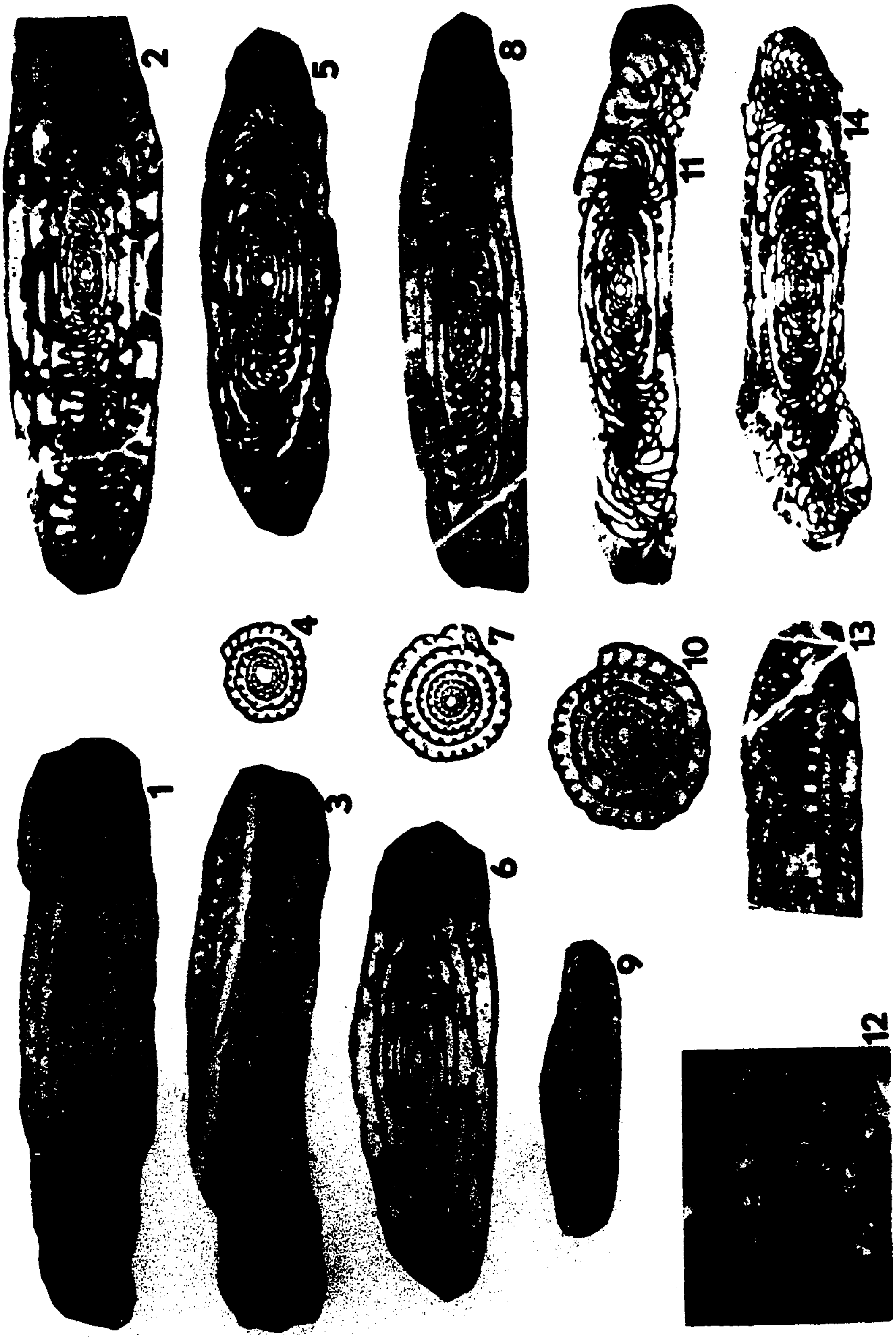
PLATE 8

Explanation of Plate 9

All figures X10 except as noted

Figs. 1-14: Eoparafusulina mendenhalli Petocz, n. sp., from assemblage zone C in the Alternating Limestone-Shale Member. 1, Holotype, UA2264, loc. DR-14; 2, 3, 9, paratypes, UA2258, UA2282, UA2275, loc. DR-14; 5, 6, 8, 11, paratypes, UA2247, UA2249, UA2293, UA2288, loc. RC-15; 14, paratype, UA2304, loc. RC-16; 4, 10, sagittal sections, UA2307, UA2310, loc. RC-15; 7, sagittal section, UA2315, loc. DR-14; 13, oblique section showing cuniculi, UA2335, loc. DR-14; 12, enlargement of fig. 13 showing cuniculi, X35.

PLATE 9



Explanation of Plate 10

All figures X10 except as noted

Figs. 1-13: Eoparafusulina waddelli Petocz, n. sp., from assemblage zone C in the Alternating Limestone-Shale Member. 1, 2, Paratypes, UA2379, loc. RC-18, UA2392, loc. RC-19; 3, holotype, UA2381, loc. R RC-19; 4, 7, sagittal sections, UA2407, UA2404, loc. RC-19; 5, 6, 9, 12, 13, paratypes, UA2393, UA2383, UA2400, UA2391, UA2398, loc. RC-19; 10, paratype, UA2377, loc. RC-18; 8, oblique section showing cuniculi, UA2414, loc. RC-19; 11, enlargement of fig. 8 showing cuniculi, X35.

PLATE 10

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APPENDIX

The parameters in the Appendix Tables are expressed in the following quantities:

Half Length	HL	mm
Radius Vector	RV	mm
Protheca Thickness	PT	microns
Tunnel Width	TW	mm
Form Ratio	FR	-
Tightness of Spire	TS	%
Proloculus Diameter	Pro.	microns
Septal Count	SC	-

A dash signifies that the parameter was absent, or was not measured because of distortion, abrasion, etc.

Specimens		Axial Sections	
		UA2000	UA2001
HL	1	.18	.11
	2	.32	.23
	3	.46	.39
	4	.70	.75
	5	1.10	-
	6	1.44	1.27
	7	2.64	2.51
	8	3.18	3.31
RV	1	.09	.10
	2	.13	.15
	3	.22	.22
	4	.32	.31
	5	.44	.45
	6	.63	.66
	7	.90	.91
	8	-	1.18
PT	1	8.8	14.3
	2	14.9	17.6
	3	19.8	13.2
	4	31.9	19.3
	5	35.2	34.1
	6	31.4	32.5
	7	37.4	30.3
	8	-	50.1

Table 1a, Part 1. Measurements of *Pseudofusulinella* sp. A

Specimens		Axial Sections UA2000	UA2001
TW	0	.03	.03
	1	.04	.03
	2	.06	.06
	3	.12	.09
	4	.15	.12
	5	.18	.21
	6	.30	.33
	7	.62	.46
FR	1	1.97	1.15
	2	2.37	1.46
	3	2.14	1.77
	4	2.18	2.42
	5	2.51	-
	6	2.28	1.92
	7	2.94	2.77
	8	-	2.80
TS	1	50.2	55.1
	2	59.6	40.7
	3	48.0	42.4
	4	36.6	44.3
	5	43.6	47.2
	6	42.5	37.3
	7	-	30.5
	8		
Pro.	Max.	129.8	129.8
	Min.	113.3	119.4

Table 1a, Part 2. Measurements of Pseudofusulinella sp. A

Specimens		Sagittal Sections UA2002	UA2003	UA2004	UA2005	UA2006	UA2007
RV	1	.116	.102	.110	.122	.143	.090
	2	.118	-	.170	.192	.220	.137
	3	.280	.230	-	.268	.313	.227
	4	.384	.343	-	.354	.398	.363
	5	.526	.477	-	.472	-	-
	6	.724	-	-	-	-	-
PT	1	9.4	9.4	10.5	14.3	11.6	9.4
	2	14.3	-	13.2	15.4	14.9	9.9
	3	18.2	17.6	-	18.2	13.8	13.8
	4	24.2	19.3	-	17.1	15.4	20.4
	5	21.5	-	-	-	-	-
SC	1	8	10	8	7	9	7
	2	14	14	14	12	16	13
	3	20	15	-	15	19	15
	4	20	21	-	19	21	16
	5	22	22	-	22	-	17
Pro.	Max.	104.5	94.2	116.1	112.8	117.2	100.7
	Min.	91.3	79.2	95.7	94.6	106.2	84.7

Table 1b. Measurements of Pseudofusulinella sp. A

		Axial Sections								
Specimens		UA2013	UA2014	UA2015	UA2016	UA2017	UA2018	UA2019	UA2020	UA2021
	1	.13	.14	.13	.16	.13	.10	.09	.11	.13
	2	.28	.37	.31	.27	.27	.23	.23	.22	.27
HL	3	.48	.72	.48	.53	.45	.41	.37	.47	.35
	4	.71	1.02	.73	.81	.72	.73	1.19	.74	.50
	5	1.16	1.71	1.21	1.02	.96	1.17	1.57	1.15	.90
	6	1.82	2.08	2.00	-	1.41	1.50	2.15	1.73	1.45
	7	-	3.06	2.64	-	-	-	-	2.33	1.86
	8	-	-	-	-	-	-	-	2.78	2.41
	1	.12	.11	.11	.10	.08	.09	.08	.08	.09
	2	.18	.17	.16	.15	.14	.15	.13	.16	.13
RV	3	.25	.24	.25	.24	.22	.26	.21	.23	.21
	4	.34	.36	.36	.35	.31	.38	.30	.33	.28
	5	.52	.50	.52	.50	.43	.51	.42	.44	.40
	6	.74	.70	.73	.72	.61	.69	.61	.63	.55
	7	-	.87	-	-	-	-	.83	.88	.73
	8	-	-	-	-	-	-	-	1.16	-
	1	9.9	12.1	11.0	10.5	12.1	12.1	10.5	8.8	9.4
	2	21.5	18.7	12.1	19.8	13.8	14.3	12.7	12.7	16.5
PT	3	18.2	26.4	19.3	20.9	15.4	20.4	12.1	13.2	19.3
	4	22.0	28.6	22.6	22.6	23.1	23.1	12.7	19.8	21.5
	5	38.5	20.9	27.5	28.1	22.0	23.7	17.6	19.3	24.8
	6	46.2	25.3	-	-	26.4	33.0	23.1	24.2	18.2
	7	-	-	-	-	-	-	29.2	19.3	-
	8	-	-	-	-	-	-	-	42.9	-

Table 2a, Part 1. Measurements of Pseudofusulinella (Kanmeria) valkenburghae Petocz, n. sp.

		Axial Sections								
Specimens		UA2013	UA2014	UA2015	UA2016	UA2017	UA2018	UA2019	UA2020	UA2021
TW	0	.04	.04	.04	.04	.03	-	.02	-	.03
	1	.05	.06	.07	.05	.06	.05	.05	.05	.04
	2	.09	.10	.09	.07	.07	.08	.08	.06	.05
	3	.10	.15	.12	.09	.12	.10	.10	.10	.08
	4	.18	.21	.22	.16	.16	.18	.14	.12	.11
	5	.32	.35	.35	-	.24	.24	.27	.21	.18
	6	-	-	.46	-	.30	.34	.43	.32	.35
	7	-	-	-	-	-	-	-	-	.37
FR	1	1.09	1.30	1.17	1.56	1.57	1.12	1.14	1.37	1.43
	2	1.50	2.20	1.92	1.74	1.87	1.49	1.73	1.38	2.02
	3	1.90	3.02	1.93	2.23	2.00	1.55	1.79	2.02	1.68
	4	2.09	2.80	2.04	2.30	2.28	1.93	3.96	2.26	1.78
	5	2.25	3.38	2.33	2.05	2.24	2.27	3.77	2.64	2.23
	6	2.45	2.97	2.75	-	2.30	2.18	3.54	2.76	2.62
	7	-	3.52	-	-	-	-	-	2.64	2.56
	8	-	-	-	-	-	-	-	2.39	-
TS	1	55.8	56.9	53.1	52.8	65.2	74.3	56.0	93.1	53.8
	2	36.3	43.2	53.1	54.7	58.3	71.4	59.0	43.3	54.8
	3	36.2	51.8	43.2	47.3	40.0	43.4	44.3	41.7	36.2
	4	51.4	39.3	44.7	41.2	37.1	35.4	38.1	32.4	41.9
	5	44.1	38.2	40.0	44.4	42.5	34.1	46.0	43.8	37.3
	6	-	24.5	-	-	-	-	36.8	40.8	31.3
	7	-	-	-	-	-	-	-	31.6	-
	8									
Pro.	Max.	153.5	144.1	155.1	124.9	96.3	112.8	86.4	102.3	126.5
	Min.	140.3	128.2	126.5	109.5	92.4	101.8	73.7	98.5	108.9

Table 2a, Part 2. Measurements of Pseudofusulinella (Kanmeria) valkenburghae Petocz, n. sp.

		Sagittal Sections				
Specimens		UA2022	UA2023	UA2024	UA2025	UA2026
RV	1	.086	.013	.122	.136	.143
	2	.129	.151	.190	.224	.207
	3	-	.222	.291	.309	.284
	4	.227	.313	.405	.464	.427
	5	.359	.438	.578	.651	-
	6	.537	-	-	-	-
	7	.729	-	-	-	-
PT	1	6.1	10.5	8.8	11.0	11.0
	2	9.6	14.9	12.7	-	12.7
	3	-	17.6	16.0	19.3	17.6
	4	17.6	15.4	20.4	28.1	29.2
	5	22.0	23.7	25.3	34.7	-
	6	41.3	-	-	-	-
SC	1	7	9	8	7	11
	2	11	12	13	11	15
	3	-	17	17	15	19
	4	-	14	20	16	17
	5	11	15	16	18	-
	6	17	17	20	-	-
Pro.	Max.	104.0	92.4	121.5	140.8	174.9
	Min.	97.9	78.1	102.9	133.1	171.1

Table 2b. Measurements of Pseudofusulinella (Kanmeria) valkenburghae Petocz, n. sp.

Specimens		Axial Sections UA2029	UA2030	UA2031
HL	1	.13	.08	.14
	2	.24	.26	.32
	3	.38	.52	.73
	4	.48	.76	1.24
	5	.74	-	-
RV	1	.08	.08	.05
	2	.15	.15	.10
	3	.21	.25	.15
	4	.30	.36	.22
	5	.41	.54	.32
PT	1	13.8	8.8	7.2
	2	19.8	12.7	11.0
	3	15.4	30.3	20.9
	4	20.9	34.7	-
	5	27.5	39.6	31.9

Table 3a, Part 1. Measurements of Pseudofusulinella (Kanmeria) cf. P. (K.) parvula Skinner and Wilde

Specimens		Axial Sections UA2029	UA2030	UA2031
TW	0	.03	.02	-
	1	.04	.04	.04
	2	.06	.07	.05
	3	.07	.10	.13
	4	.15	.14	.20
	5	.21	.20	-
FR	1	1.47	.98	-
	2	1.57	1.74	-
	3	1.76	2.04	-
	4	1.60	2.13	-
	5	1.81	-	-
TS	1	79.5	75.0	74.5
	2	40.8	72.8	53.1
	3	39.7	40.2	51.7
	4	36.1	52.5	43.5
	5			
Pro.	Max.	107.8	89.1	83.1
	Min.	94.6	88.0	69.3

Table 3a, Part 2. Measurements of Pseudofusulinella (Kanmeria) cf. P. (K.) parvula Skinner and Wilde

Sagittal Section

Specimen		UA2032
RV	1	.113
	2	.161
	3	.229
	4	.331
	5	.415
PT	1	11.0
	2	12.7
	3	16.5
	4	20.4
	5	20.4
SC	1	12
	2	16
	3	17
Pro.	Max.	97.9
	Min.	91.9

Table 3b. Measurements of Pseudofusulinella (Kanmeria) cf. P. (K.) parvula Skinner and Wilde

Axial Sections

Specimens		UA2033	UA2034	UA2035	UA2036	UA2037	UA2038	UA2039	UA2040	UA2041
	1	.11	.09	.22	.10	.09	.10	.13	.14	.11
	2	.21	.23	.55	.22	.24	.30	.32	.43	.23
HL	3	.40	.43	.97	.39	.53	.58	.73	.68	.61
	4	.70	.84	-	-	.97	.94	1.30	1.39	.94
	5	-	-	-	-	-	1.45	-	-	1.33
	6	-	-	-	-	-	-	-	-	2.13
	1	.07	.10	.14	.10	.08	.11	.11	.12	.09
	2	.13	.16	.22	.15	.14	.16	.18	.19	.14
RV	3	.19	.25	.37	.22	.22	.23	.30	.31	.23
	4	.31	.39	-	-	.35	.34	.46	.48	.35
	5	-	-	-	-	-	.52	-	-	.59
	1	14.9	11.6	17.1	9.9	13.2	12.7	18.7	11.6	8.3
	2	18.2	19.8	23.7	25.9	20.4	20.9	17.1	20.9	10.5
PT	3	17.6	22.6	38.0	22.6	21.5	20.9	35.2	29.7	22.6
	4	-	38.5	-	-	30.3	27.5	-	48.4	31.9
	5	-	-	-	-	-	51.2	-	-	50.6

Table 4a, Part 1. Measurements of *Schwagerina* cf. *S. emaciata* (Beede)

Specimens		Axial Sections UA2033	UA2034	UA2035	UA2036	UA2037	UA2038	UA2039	UA2040	UA2041
TW	0	.02	.04	.06	-	.03	.03	.04	.04	.04
	1	.05	.05	.11	.06	.05	.05	.06	.06	.06
	2	.09	.07	.23	.10	.08	.08	-	.10	.09
	3	.13	.15	-	-	.10	.14	-	.21	.17
	4	-	.25	-	-	-	-	-	-	.19
	5	-	-	-	-	-	-	-	-	.19
FR	1	1.51	.96	1.54	1.07	1.15	.92	1.23	1.25	1.25
	2	1.67	1.39	2.43	1.47	1.78	1.90	1.80	2.25	1.58
	3	2.07	1.71	2.60	1.77	2.40	2.52	2.44	2.19	2.65
	4	2.28	2.17	-	-	2.80	2.72	2.82	2.87	2.69
	5	-	-	-	-	-	2.77	-	-	2.24
TS	1	71.8	70.9	59.9	52.5	64.1	41.7	60.7	63.6	67.6
	2	51.5	52.3	65.9	47.5	61.9	47.6	70.5	62.7	57.5
	3	59.8	54.5	-	-	57.1	49.1	53.5	57.0	52.4
	4	-	-	-	-	-	52.0	-	-	70.1
	5									
Pro.	Max.	103.4	121.0	181.0	116.1	97.4	139.7	163.4	144.1	112.8
	Min.	85.3	112.2	151.3	112.8	83.1	137.5	124.9	119.4	95.7

Table 4a, Part 2. Measurements of Schwagerina cf. S. emaciata (Beede)

Specimens		Axial Sections UA2042	UA2043	UA2044	UA2045	UA2046
HL	1	.16	.10	.28	.13	.15
	2	.35	.31	.72	.29	.39
	3	.71	.58	1.22	.54	.81
	4	-	.91	1.90	.92	1.22
	5	1.94	1.92	-	1.37	-
	6	-	-	-	-	-
RV	1	.11	.10	.17	.09	.11
	2	.18	.15	.33	.15	.18
	3	.28	.23	.57	.24	.30
	4	.42	.33	.98	.37	.43
	5	.70	.57	-	.61	-
PT	1	12.1	12.1	20.4	12.1	9.4
	2	16.5	13.2	36.9	16.0	16.5
	3	23.7	18.2	51.2	20.9	29.2
	4	42.9	44.6	64.9	30.3	35.8
	5	-	83.6	-	80.9	-

Table 4b, Part 1. Measurements of Schwagerina cf. S. emaciata (Beede)

		Axial Sections				
Specimens		UA2042	UA2043	UA2044	UA2045	UA2046
TW	0	.03	.03	.06	.04	.03
	1	.04	.04	-	.04	.07
	2	.09	.06	-	.06	.11
	3	.16	.15	-	-	.13
	4	.30	.20	-	-	-
	5	-	-	-	-	-
FR	1	1.45	1.04	1.59	1.42	1.38
	2	1.94	2.08	2.15	1.93	2.16
	3	2.56	2.57	2.12	2.26	2.68
	4	-	2.73	1.94	2.48	2.83
	5	2.79	3.37	-	2.24	-
TS	1	64.5	52.5	92.0	65.0	62.1
	2	55.6	51.6	71.6	56.2	66.3
	3	52.6	47.0	70.7	54.2	42.5
	4	63.9	70.6	-	65.7	-
	5					
Pro.	Max.	143.0	132.6	177.7	108.4	149.6
	Min.	130.4	118.3	160.6	98.5	125.4

Table 4b, Part 2. Measurements of <u>Schwagerina</u> cf. <u>S. emaciata</u> (Beede)

		Sagittal Sections	
Specimens		UA2047	UA2048
	1	.137	.136
	2	.234	.208
RV	3	-	.343
	4	-	.574
	1	15.4	12.7
	2	19.3	18.7
PT	3	-	34.1
	4	-	67.1
	1	8	8
	2	-	15
SC	3	-	16
	4	-	21
Pro.	Max.	117.7	106.7
	Min.	106.2	103.4

Table 4c. Measurements of _Schwagerina_ cf. _S. emaciata_ (Beede)

Specimens		UA2050	UA2051	UA2052	UA2053	UA2054	UA2055	UA2056	UA2057
		Axial Sections							
HL	1	.23	.15	.28	.15	.16	.16	.14	.16
	2	.46	.30	.61	.30	.36	.34	.28	.27
	3	.81	.44	.85	.48	.55	.56	.49	.46
	4	1.34	.75	1.16	.89	.91	.77	.84	.70
	5	2.27	1.20	1.73	1.55	1.47	1.34	1.79	1.11
	6	2.65	2.00	2.71	2.65	2.00	2.54	2.65	1.78
	7	-	2.41	3.72	3.60	3.17	-	3.62	2.81
	8	-	-	-	-	-	-	-	3.50
RV	1	.11	.10	.16	.12	.11	.13	.12	.09
	2	.19	.16	.24	.19	.17	.21	.18	.13
	3	.30	.22	.37	.28	.25	.33	.26	.20
	4	.49	.34	.53	.41	.37	.49	.39	.31
	5	.78	.45	.72	.66	.58	.78	.61	.46
	6	1.16	.66	1.06	.94	.84	-	.93	.81
	7	-	-	-	1.40	1.29	-	1.47	1.22
PT	1	18.7	15.4	12.7	9.9	11.6	9.4	12.1	12.7
	2	23.1	17.6	15.4	17.6	19.8	22.0	16.5	12.7
	3	35.2	24.8	22.0	25.3	23.1	27.0	30.3	21.5
	4	71.0	37.4	39.1	35.2	44.0	52.3	29.2	-
	5	68.2	40.2	45.1	71.5	68.2	62.7	72.1	43.5
	6	102.4	69.9	71.5	71.5	65.5	-	73.5	-
	7	-	92.4	-	100.7	-	-	71.5	-

Table 5a, Part 1. Measurements of <u>Schwagerina</u> <u>pseudokaragasensis</u> Petocz, n. sp.

Specimens		Axial Sections UA2050	UA2051	UA2052	UA2053	UA2054	UA2055	UA2056	UA2057
	0	.05	.04	.05	.05	.04	.04	.02	.04
	1	.08	.05	.06	.05	.07	.07	.06	.05
TW	2	.13	.10	-	.08	.09	.10	.08	.08
	3	.18	.12	.12	.14	.13	-	.15	.11
	4	.36	.20	-	-	.20	-	.22	.18
	5	.61	.26	-	-	-	-	-	-
	6	-	.37	-	-	-	-	-	-
	1	2.00	1.42	1.79	1.28	1.37	1.22	1.19	1.82
	2	2.37	1.96	2.57	1.58	2.04	1.60	1.62	2.08
FR	3	2.66	2.03	2.29	1.74	2.22	1.71	1.88	2.32
	4	2.71	2.22	2.19	2.14	2.47	1.55	2.16	2.27
	5	2.89	2.64	2.41	2.36	2.55	1.72	2.95	2.39
	6	2.28	3.01	2.55	2.82	2.40	-	2.83	2.20
	7	-	-	-	2.58	2.46	-	2.46	2.30
	1	67.9	49.3	53.0	61.9	52.5	59.4	52.1	49.2
	2	57.9	39.9	56.2	46.6	41.5	51.7	47.3	52.9
TS	3	61.7	54.2	42.2	48.3	48.3	51.6	50.2	56.6
	4	58.5	34.6	35.9	58.3	56.2	57.2	55.1	50.2
	5	48.7	46.3	47.0	43.1	45.1	-	54.3	73.5
	6	-	-	-	48.7	53.9	-	57.2	51.1
	7								
Pro.	Max.	-	120.5	172.7	156.8	130.9	158.4	154.0	130.9
	Min.	-	98.5	170.5	139.2	124.9	154.0	131.5	116.6

Table 5a, Part 2. Measurements of <u>Schwagerina</u> <u>pseudokaragasensis</u> Petocz, n. sp.

		Sagittal Sections		
Specimens		UA2058	UA2059	UA2060
RV	1	.124	.107	.140
	2	.207	.117	.222
	3	.347	.248	-
	4	.600	.404	.559
	5	.960	.628	-
	6	-	.915	-
PT	1	-	10.5	-
	2	27.5	-	14.9
	3	32.5	23.7	-
	4	46.8	58.9	100.7
	5	88.6	62.2	-
	6	-	81.4	-
SC	1	9	9	9
	2	14	14	15
	3	15	18	19
	4	19	17	21
	5	21	19	-
	6	-	25	-
Pro.	Max.	126.5	128.2	123.2
	Min.	120.5	115.0	113.9

Table 5b. Measurements of *Schwagerina pseudokaragasensis* Petocz, n. sp.

		Axial Sections							
Specimens		UA2061	UA2062	UA2063	UA2064	UA2065	UA2066	UA2067	UA2068
	1	.13	.11	.21	.12	.15	.13	.13	.15
	2	.20	.27	.45	.23	.32	.44	.32	.38
HL	3	.35	.54	.83	.46	.64	.75	.65	.66
	4	.68	.91	1.63	.77	1.01	1.20	1.20	-
	5	1.17	1.49	2.33	1.32	1.74	2.00	1.79	-
	6	-	-	3.57	2.00	2.65	2.41	-	-
	1	.11	.09	.14	.11	.12	.10	.09	.10
	2	.16	.15	.20	.18	.19	.19	.18	.17
RV	3	.23	.22	.31	.28	.29	.28	.33	.26
	4	.37	.38	.47	.45	.44	.45	.55	-
	5	.63	.65	.76	.73	.76	.68	.86	-
	6	-	-	1.91	-	1.13	1.04	-	-
	7	-	-	1.50	-	-	-	-	-
	1	11.0	16.5	19.8	13.8	24.8	11.0	11.0	11.6
	2	23.1	14.9	18.7	28.1	23.1	23.7	13.2	14.3
PT	3	24.8	24.2	37.4	23.7	-	34.1	36.9	23.1
	4	40.2	44.6	42.4	43.5	73.7	40.2	60.5	-
	5	69.9	67.1	80.9	87.5	73.2	64.9	75.9	-
	6	-	-	99.0	96.3	-	102.4	-	-

Table 6, Part 1. Measurements of Schwagerina sp. A

		Axial Sections							
Specimens		UA2061	UA2062	UA2063	UA2064	UA2065	UA2066	UA2067	UA2068
TW	0	.03	.03	.05	.02	.03	.04	.03	.04
	1	.05	.04	.08	.06	.06	.07	.06	.06
	2	.11	.07	.09	.12	.09	.09	.13	.10
	3	.14	.12	.21	.19	.17	.18	.19	-
	4	-	.22	-	.37	-	.29	-	-
FR	1	1.16	1.19	1.50	1.05	1.28	1.33	1.50	1.52
	2	1.25	1.84	2.24	1.30	1.66	2.37	1.82	2.20
	3	1.49	2.44	2.62	1.64	2.21	2.62	1.97	2.54
	4	1.84	2.42	3.45	1.70	2.29	2.68	2.21	-
	5	1.85	2.28	3.06	1.82	2.30	2.91	2.08	-
	6	-	-	3.00	-	2.36	2.32	-	-
TS	1	50.2	60.5	41.7	56.9	64.9	88.7	101.5	75.8
	2	43.8	50.4	55.8	58.9	49.0	52.2	86.6	52.5
	3	57.9	70.7	50.2	61.2	52.5	56.5	65.6	-
	4	71.9	73.8	61.2	61.0	71.9	53.6	57.4	-
	5	-	-	55.8	-	48.2	51.8	-	-
	6	-	-	26.2	-	-	-	-	-
	7								
Pro.	Max.	126.0	122.1	121.6	112.2	143.6	118.3	105.6	105.6
	Min.	105.6	106.2	110.0	109.5	135.3	113.3	98.5	95.7

Table 6, Part 2. Measurements of Schwagerina sp. A

		Axial Sections								
Specimens		UA2070	UA2071	UA2072	UA2073	UA2074	UA2075	UA2076	UA2077	UA2078
	1	.23	.17	.14	.15	.23	.24	.12	.26	-
	2	.39	.30	.30	.32	.50	.48	.25	.42	-
HL	3	.63	.48	.70	-	.81	.72	.53	.77	.74
	4	-	1.03	1.16	1.35	1.40	1.35	-	1.31	1.24
	5	-	1.55	1.78	2.67	2.33	2.14	1.59	2.09	2.09
	6	-	-	-	-	-	3.10	2.37	2.70	2.87
	7	-	-	-	-	-	-	-	-	-
	1	.15	.12	.09	.15	.18	.15	.12	.14	.14
	2	.23	.17	.15	.25	.29	.25	.19	.24	.22
RV	3	.32	.24	.21	.35	.44	.35	.30	.37	.33
	4	.48	.39	.32	.56	.66	.54	.46	.55	.50
	5	.76	.61	.50	.85	.93	.93	.77	.95	.76
	6	-	-	.69	-	-	1.39	1.17	1.39	1.18
	1	23.7	13.8	9.4	17.1	16.5	11.6	14.9	18.2	14.9
	2	18.7	16.5	10.5	28.6	17.6	13.2	19.8	30.3	23.1
PT	3	24.2	32.5	19.3	29.7	16.5	28.1	15.4	50.1	43.5
	4	57.2	40.2	30.3	-	59.4	45.7	33.6	61.6	63.8
	5	82.0	58.3	45.7	80.3	93.5	106.2	78.7	-	116.7
	6	-	-	-	-	-	140.3	-	-	-

Table 7a, Part 1. Measurements of Schwagerina rowetti Petocz, n. sp.

Specimens		Axial Sections UA2070	UA2071	UA2072	UA2073	UA2074	UA2075	UA2076	UA2077	UA2078
TW	0	.05	.03	.03	.04	.05	.04	.03	.04	.04
	1	.06	.04	.05	.05	.06	.06	.07	.08	.06
	2	.12	.06	.06	.08	.11	.13	.10	.10	.10
	3	.19	.12	.12	.19	-	.18	-	.24	.18
	4	.29	.22	.17	-	-	-	-	-	-
FR	1	1.52	1.43	1.46	1.00	1.26	1.60	1.03	1.76	-
	2	1.68	1.81	2.03	1.31	1.73	1.92	1.33	1.79	-
	3	1.95	1.98	3.32	-	1.85	2.06	1.75	2.07	2.27
	4	-	2.62	3.63	2.40	2.11	2.48	-	2.40	2.49
	5	-	2.53	3.52	3.15	2.50	2.29	2.06	2.21	2.75
	6	-	-	-	-	-	2.23	2.02	1.94	2.42
TS	1	53.1	42.6	55.4	67.8	58.9	66.4	59.6	63.0	58.4
	2	39.7	45.3	42.9	41.5	51.1	39.6	61.4	56.6	48.1
	3	49.9	62.0	52.4	59.9	51.3	55.9	53.0	46.9	51.4
	4	57.8	56.6	57.4	50.3	40.3	71.9	66.0	73.3	52.9
	5	-	-	37.7	-	-	48.7	52.2	46.6	55.8
	6									
Pro.	Max.	174.9	156.8	130.9	174.4	238.7	185.9	144.1	173.8	168.3
	Min.	171.1	156.8	124.3	172.2	222.8	178.8	143.0	172.2	165.0

Table 7a, Part 2. Measurements of Schwagerina rowetti Petocz, n. sp.

	Specimen	Axial Section UA2079
HL	1	.11
	2	.28
	3	.48
	4	.78
	5	1.24
	6	2.15
	7	3.03
RV	1	.08
	2	.15
	3	.22
	4	.35
	5	.63
	6	.98
PT	1	11.0
	2	15.4
	3	18.2
	4	54.5
	5	81.4
	6	68.8

Table 7b, Part 1. Measurements of *Schwagerina rowetti* Petocz, n. sp.

		Axial Section
Specimen		UA2079
TW	0	.03
	1	.05
	2	.08
	3	.12
	4	.21
FR	1	1.32
	2	1.80
	3	2.14
	4	2.21
	5	1.97
	6	2.20
TS	1	
	2	80.6
	3	44.6
	4	60.1
	5	76.6
	6	55.7
Pro.	Max.	-
	Min.	-

Table 7b, Part 2. Measurements of Schwagerina rowetti Petocz, n. sp.

Sagittal Section

Specimen		UA2080
RV	1	.175
	2	.277
	3	-
	4	.665
	5	-
PT	1	18.7
	2	24.8
	3	31.4
	4	62.7
SC	1	11
	2	15
	3	22
	4	23
Pro.	Max.	155.1
	Min.	148.5

Table 7c. Measurements of Schwagerina rowetti Petocz, n. sp.

Specimens		Axial Sections UA2084	UA2085	UA2086	UA2087	UA2088	UA2089
	1	.19	.26	.13	.23	.26	.20
	2	.39	.59	.36	.52	.46	.53
HL	3	.56	1.03	.69	1.02	.82	.82
	4	1.02	1.54	.98	1.60	-	1.21
	5	2.05	2.39	-	2.59	2.66	2.04
	6	3.35	3.26	2.75	-	-	-
	7	4.42	-	-	-	-	-
	1	.15	.15	.11	.14	.13	.13
	2	.22	.26	.18	.23	.22	.21
RV	3	.32	.41	.28	.32	.33	.34
	4	.46	.61	.43	.55	-	.54
	5	.70	.85	.67	.83	-	-
	6	1.00	1.28	1.08	-	-	-
	1	16.0	19.3	13.8	16.0	12.7	18.2
	2	24.2	25.3	23.7	31.4	22.6	23.7
PT	3	23.7	40.7	33.0	42.9	51.2	31.9
	4	53.4	47.9	41.3	74.3	-	58.3
	5	71.5	81.4	71.0	97.4	-	-
	6	69.3	107.3	80.3	-	-	-

Table 8a, Part 1. Measurements of Schwagerina callosa (Rauser-Chernousova)

Specimens		UA2084	UA2085	UA2086	UA2087	UA2088	UA2089
		Axial Sections					
TW	0	.04	.05	.04	.04	.04	.05
	1	.06	.07	.04	.07	.06	.08
	2	.09	.11	.09	.14	-	.10
	3	.16	.17	.16	.24	.12	.30
	4	-	.56	-	-	-	-
	5	.51	-	-	-	-	-
FR	1	1.32	1.78	1.18	1.63	2.06	1.58
	2	1.80	2.27	2.03	2.32	2.11	2.50
	3	1.78	2.49	2.43	3.20	2.50	2.38
	4	2.22	2.53	2.31	2.90	-	2.26
	5	2.93	2.81	-	3.11	-	-
	6	3.34	2.55	2.54	-	-	-
TS	1	48.9	76.7	66.1	58.5	70.4	71.2
	2	44.6	59.5	60.4	40.5	50.7	60.7
	3	44.9	46.7	50.5	73.0	-	56.1
	4	52.5	39.7	57.1	51.6	-	-
	5	42.9	50.3	61.3	-	-	-
	6						
Pro.	Max.	186.5	199.7	103.4	172.2	193.1	163.9
	Min.	181.0	168.3	100.7	163.9	185.4	130.9

Table 8a, Part 2. Measurements of Schwagerina callosa (Rauser-Chernousova)

Specimen		Sagittal Section UA2090
RV	1	.177
	2	.284
	3	.460
	4	.692
	5	1.117
PT	1	15.4
	2	-
	3	42.9
	4	-
	5	79.8
SC	1	-
	2	24
	3	28
	4	27
	5	31
Pro.	Max.	148.5
	Min.	125.4

Table 8b. Measurements of Schwagerina callosa (Rauser-Chernousova)

		Axial Sections								
Specimens		UA2094	UA2095	UA2096	UA2097	UA2098	UA2099	UA2100	UA2101	UA2102
	1	.16	.16	.15	.13	.15	.15	.28	.16	.26
	2	.31	.31	.42	.38	.29	.33	.50	.40	.58
HL	3	.63	.63	.78	.76	.74	.59	.90	.85	1.11
	4	.94	1.08	1.43	1.27	1.32	.106	1.78	1.41	2.15
	5	1.73	-	2.37	2.14	2.22	-	3.07	2.49	-
	6	2.61	-	-	2.64	-	-	4.80	-	-
	7	-	-	-	-	-	-	-	-	-
	1	.15	.13	.16	.08	.15	.14	.16	.13	.17
	2	.25	.21	.25	.17	.25	.23	.25	.21	.30
RV	3	.36	.36	.42	.31	.40	.36	.40	.36	.45
	4	.61	.68	.62	.52	.64	.58	.66	.57	.70
	5	1.01	-	-	.90	-	-	1.02	.81	-
	6	-	-	-	1.24	-	-	1.41	-	-
	1	13.2	20.4	14.9	15.4	12.1	14.9	17.1	9.9	14.9
	2	17.6	21.5	24.2	16.5	22.0	19.8	25.9	17.1	25.9
PT	3	25.9	46.8	49.0	38.0	40.7	33.0	34.7	31.9	45.7
	4	50.6	-	-	45.7	71.0	57.8	76.5	78.7	50.6
	5	91.3	-	82.0	-	-	-	89.7	52.8	-
	6	-	-	-	-	-	-	90.8	-	-
	7	-	-	-	-	-	-	-	-	-

Table 9a, Part 1. Measurements of *Schwagerina whartoni*, Petocz, n. sp.

		Axial Sections								
Specimens		UA2094	UA2095	UA2096	UA2097	UA2098	UA2099	UA2100	UA2101	UA2102
TW	0	.05	.06	.05	-	.06	.05	.06	.05	.06
	1	.06	.11	.09	-	.08	.08	.10	.08	.12
	2	.11	-	.14	-	.14	.15	.18	.15	.21
	3	.19	-	-	-	.29	.27	-	.34	-
	4	.34	-	-	-	-	-	-	.69	-
	5	-	-	-	-	-	-	-	-	-
FR	1	1.04	1.25	.95	1.50	1.00	1.09	1.73	1.26	1.51
	2	1.26	1.49	1.70	2.21	1.18	1.45	1.96	1.93	1.96
	3	1.74	1.73	1.85	2.41	1.83	1.62	2.28	2.35	2.45
	4	1.55	1.57	2.32	2.45	2.08	1.83	2.68	2.48	3.06
	5	1.71	-	-	2.37	-	-	3.01	3.09	-
	6	-	-	-	2.13	-	-	3.40	-	-
TS	1	60.5	67.8	59.2	106.9	64.9	60.8	59.6	62.7	75.0
	2	46.3	71.1	69.0	83.2	62.2	58.5	55.5	74.9	52.5
	3	67.7	89.5	47.0	64.6	57.8	61.0	67.1	56.5	55.3
	4	66.9	-	-	74.2	-	-	38.4	-	-
	5	-	-	-	37.1	-	-	38.4	-	-
	6									
Pro.	Max.	193.6	140.3	123.8	-	183.7	172.7	225.5	163.4	228.8
	Min.	186.5	130.9	172.2	-	177.7	170.0	195.8	154.0	196.9

Table 9a, Part 2. Measurements of Schwagerina whartoni, Petocz, n. sp.

		Axial Sections								
Specimens		UA2103	UA2104	UA2105	UA2106	UA2107	UA2108	UA2109	UA2110	UA2111
HL	1	.27	.19	.21	.30	.16	.20	.18	.30	.26
	2	.70	.49	.55	.71	.41	.44	.45	.64	.64
	3	1.56	.95	1.01	1.44	.77	.90	.96	1.03	1.30
	4	2.21	1.74	1.88	2.00	1.46	1.21	1.62	1.91	2.02
	5	3.05	2.58	2.76	3.65	2.11	2.11	2.65	3.23	-
	6	-	-	4.02	-	3.18	3.10	3.86	-	-
	7	-	-	-	-	-	4.36	-	-	-
RV	1	.15	.17	.14	.18	.11	.09	.13	.14	.15
	2	.26	.27	.22	.28	.19	.15	.21	.23	.28
	3	.48	.41	.39	.47	.32	.22	.35	.43	.48
	4	.80	.61	.63	.73	.50	.36	.58	.70	.78
	5	1.23	.89	.99	1.01	.79	.56	.93	1.10	1.13
	6	-	-	1.32	-	1.16	1.24	1.40	-	-
PT	1	16.5	18.2	13.2	17.1	12.7	12.1	13.2	16.0	16.5
	2	26.4	26.4	21.5	22.6	20.9	16.0	23.1	20.4	30.8
	3	53.4	36.3	34.7	44.0	29.2	41.3	58.9	40.7	-
	4	74.3	71.0	99.6	59.4	47.9	58.3	54.5	62.7	88.0
	5	74.8	83.1	73.2	56.7	97.9	79.2	89.7	97.9	99.6
	6	-	-	78.7	-	72.6	92.4	142.5	-	-
	7	-	-	-	-	-	99.0	-	-	-

Table 9b, Part 1. Measurements of Schwagerina whartoni, Petocz, n. sp.

Specimens		UA2103	UA2104	UA2105	UA2106	UA2107	UA2108	UA2109	UA2110	UA2111
		Axial Sections								
TW	0	.07	.05	.06	.07	.05	.06	.05	.07	.06
	1	.13	.10	.11	.14	.08	.10	.09	.13	.14
	2	.31	.25	.22	.31	.12	.16	.16	.25	.26
	3	.46	.64	.32	-	.28	.23	.37	.53	-
	4	1.21	-	1.24	-	.47	.72	.64	.60	-
	5	-	-	-	-	-	-	-	-	-
FR	1	1.79	1.13	1.47	1.73	1.38	2.20	1.41	2.12	1.66
	2	2.65	1.79	2.44	2.49	2.14	2.98	2.13	2.74	2.27
	3	3.25	2.30	2.59	3.05	2.44	4.08	2.75	2.41	2.73
	4	2.78	2.84	2.97	2.75	2.90	3.35	2.80	2.73	2.60
	5	2.47	2.88	2.80	3.60	2.67	3.79	2.83	2.93	-
	6	-	-	3.04	-	2.74	3.86	2.75	-	-
TS	1	73.4	62.8	55.0	60.9	66.1	63.6	62.8	61.9	83.5
	2	81.3	50.9	73.4	65.7	66.5	50.4	65.0	83.3	68.1
	3	66.0	47.7	61.9	54.6	59.1	64.6	65.0	64.0	63.1
	4	55.0	46.1	56.1	39.1	56.9	53.7	61.7	57.7	45.2
	5	-	-	33.6	-	47.2	43.9	49.8	-	-
	6									
Pro.	Max.	202.4	211.2	191.4	230.5	148.5	211.8	169.4	182.1	194.7
	Min.	184.3	191.4	181.5	205.2	134.2	183.7	154.6	167.8	192.5

Table 9b, Part 2. Measurements of <u>Schwagerina</u> <u>whartoni</u>, Petocz, n. sp.

Specimens		UA2112	UA2113	UA2114	UA2115	UA2116	UA2117	UA2118	UA2119	UA2120
		Axial Sections								
	1	.22	.23	.20	.10	.20	.22	.15	.13	.24
	2	.54	.62	.43	.18	.47	.41	.28	.32	.51
HL	3	.71	1.08	.81	.40	.78	.79	.60	.63	.98
	4	2.01	1.64	1.36	.91	1.79	1.26	1.36	1.38	1.97
	5	3.37	2.87	2.42	1.74	2.86	2.12	2.12	2.21	-
	6	-	4.01	3.57	2.77	-	2.93	-	-	-
	7	-	-	-	-	-	-	-	-	-
	1	.17	.15	.13	.10	.14	.15	.13	.10	.23
	2	.27	.24	.21	.16	.24	.22	.19	.16	.35
RV	3	.43	.40	.34	.26	.37	.34	.30	.27	.55
	4	.65	.63	.58	.40	.63	.54	.48	.48	.86
	5	.98	.96	.91	.61	.98	.86	.75	.69	-
	6	-	1.32	1.26	.90	-	1.29	-	1.10	-
	1	12.7	12.1	7.7	11.0	16.5	19.8	10.5	9.4	29.2
	2	25.3	23.7	26.4	16.5	20.9	38.0	-	19.3	52.8
PT	3	38.0	38.5	35.8	14.9	60.5	24.8	31.4	38.5	51.2
	4	50.6	52.3	60.5	22.0	81.4	74.3	75.9	57.2	95.2
	5	108.4	114.5	84.2	42.9	-	81.4	-	-	-
	6	-	81.4	66.0	90.9	-	96.8	-	87.5	-
	7	-	-	-	-	-	-	-	-	-

Table 9c, Part 1. Measurements of Schwagerina whartoni, Petocz, n. sp.

		Axial Sections								
Specimens		UA2112	UA2113	UA2114	UA2115	UA2116	UA2117	UA2118	UA2119	UA2120
TW	0	.06	.08	.05	-	.05	.05	.04	.03	.05
	1	.13	.12	.10	-	.05	.09	.08	.07	.11
	2	.23	-	.20	.10	.12	.14	.17	.16	-
	3	.43	-	.23	.28	-	-	.28	.25	.34
	4	.69	.66	.43	.38	-	-	-	-	-
	5	-	-	.62	-	-	.69	-	-	-
FR	1	1.32	1.50	1.51	1.03	1.40	1.49	1.15	1.34	1.06
	2	2.04	2.54	2.02	1.16	1.99	1.86	1.45	1.98	1.46
	3	1.66	2.70	2.41	1.54	2.11	2.30	2.31	2.34	1.77
	4	3.06	2.62	2.35	2.29	2.85	2.34	2.81	2.88	2.28
	5	3.43	2.99	2.66	2.77	2.91	2.47	2.82	3.22	-
	6	-	3.04	2.83	3.10	-	2.27	-	-	-
TS	1	58.6	58.0	60.8	60.1	68.7	51.3	45.4	60.8	51.4
	2	61.6	65.3	57.4	63.8	54.9	53.9	55.5	65.2	59.2
	3	51.7	55.9	72.6	53.7	70.7	57.6	62.7	78.6	56.0
	4	50.1	53.4	56.3	56.9	56.2	58.4	55.7	43.4	-
	5	-	37.4	38.8	42.8	-	50.5	-	59.9	-
	6									
Pro.	Max.	225.0	222.8	148.5	127.6	189.8	185.4	182.6	151.3	180.4
	Min.	200.8	188.7	141.4	122.1	173.3	149.6	161.2	140.3	163.4

Table 9c, Part 2. Measurements of Schwagerina whartoni, Petocz, n. sp.

Specimens		Sagittal Sections UA2121	UA2122	UA2123	UA2124
RV	1	.212	.177	.277	.182
	2	.313	.282	.452	.287
	3	.473	.445	.703	.461
	4	.756	.714	1.036	.718
	5	1.081	1.046	1.492	1.077
	6	1.546	-	-	-
PT	1	14.9	9.9	13.2	13.8
	2	27.5	23.7	24.8	20.9
	3	46.2	42.9	45.7	51.2
	4	63.3	57.2	66.0	58.9
	5	75.4	73.2	89.1	91.9
	6	-	-	84.7	-
SC	1	14	11	9	12
	2	22	16	16	18
	3	24	15	19	18
	4	27	19	19	18
	5	30	24	21	23
	6	-	-	24	-
Pro.	Max.	248.1	181.0	187.6	218.9
	Min.	198.0	179.3	178.2	210.1

Table 9d. Measurements of Schwagerina whartoni, Petocz, n. sp.

		Axial Sections								
Specimens		UA2137	UA2138	UA2139	UA2140	UA2141	UA2142	UA2143	UA2144	UA2145
	1	.11	.08	.11	.09	.13	.10	.13	.08	.08
	2	.22	.18	.25	.32	.20	.21	.29	.13	.21
HL	3	.56	.33	.38	.50	.38	.37	.66	.33	-
	4	1.00	.59	.58	-	.78	-	-	.73	-
	5	1.50	.98	.84	1.55	1.30	1.56	1.53	1.05	1.22
	6	2.40	1.61	1.54	2.05	1.89	2.11	2.13	1.57	2.07
	7	3.23	2.28	2.33	2.53	2.67	2.59	2.71	2.29	2.86
	8	-	2.97	3.07	-	-	-	-	-	-
	1	.08	.08	.09	.07	.10	.08	.08	.05	.06
	2	.13	.11	.15	.10	.16	.12	.16	.09	.12
RV	3	.22	.17	.22	.16	.24	.17	.23	.16	.17
	4	.35	.24	.36	.22	.39	.28	.35	.26	.26
	5	.69	.41	.55	.40	.59	.45	.51	.43	.42
	6	1.19	.59	.87	.69	.95	.74	.81	.69	.78
	7	-	1.00	1.29	1.11	-	1.19	-	-	-
	8	-	1.54	-	-	-	-	-	-	-
	1	17.6	9.4	11.0	9.9	12.1	15.4	19.3	11.0	16.5
	2	24.8	15.4	23.1	13.8	19.3	16.0	27.5	16.0	12.1
PT	3	19.3	20.4	23.7	23.1	23.1	28.6	34.7	29.2	33.0
	4	32.5	27.5	38.0	42.4	25.9	32.5	-	30.3	40.2
	5	69.9	33.6	62.2	52.3	38.0	51.7	51.7	43.5	56.1
	6	83.1	44.0	90.8	64.9	52.8	64.9	71.5	49.0	72.6
	7	-	69.3	97.4	68.2	88.0	84.7	-	-	-
	8	-	77.0	-	-	-	-	-	-	-

Table 10a, Part 1. Measurements of Schwagerina heineri Petocz, n. sp.

Specimens		UA2137	UA2138	UA2139	UA2140	UA2141	UA2142	UA2143	UA2144	UA2145
		Axial Sections								
TW	0	.03	.03	.03	.02	-	-	.02	.02	.02
	1	.04	.03	.03	.03	.03	.04	.04	.02	.03
	2	.07	.04	.04	.06	.04	.06	.12	.04	.05
	3	.12	.05	.10	.12	.08	.12	.13	.09	.08
	4	-	.10	-	-	-	-	-	-	-
	5	-	.20	.28	-	-	-	-	-	-
FR	1	1.29	1.08	1.29	1.32	1.31	1.30	1.57	1.48	1.28
	2	1.69	1.56	1.61	3.28	1.23	1.74	1.85	1.41	1.78
	3	2.59	2.01	1.67	3.14	1.56	2.13	2.85	2.06	-
	4	2.84	2.48	1.63	-	2.00	-	-	2.78	-
	5	2.17	2.42	1.53	3.83	2.21	3.45	2.97	2.45	2.88
	6	2.01	2.71	1.77	2.97	1.97	2.83	2.64	2.27	2.66
	7	-	2.28	1.81	2.28	-	2.18	-	-	-
	8	-	1.93	-	-	-	-	-	-	-
TS	1									
	2	57.1	42.4	71.6	42.0	56.2	50.8	81.8	71.9	79.9
	3	64.6	47.0	46.9	61.0	51.0	46.4	47.3	66.9	45.2
	4	61.7	42.1	59.2	40.7	60.5	60.3	54.1	64.0	52.2
	5	96.1	71.7	52.8	80.0	51.6	61.9	45.2	63.5	65.2
	6	73.2	45.5	59.0	70.8	61.8	65.0	56.9	61.1	83.7
	7	-	68.7	48.0	61.0	-	59.2	-	-	-
	8	-	54.3	-	-	-	-	-	-	-
Pro.	Max.	94.1	-	95.2	97.9	86.9	108.4	108.4	72.1	82.0
	Min.	85.8	-	-	90.2	86.4	106.2	102.3	64.9	75.9

Table 10a, Part 2. Measurements of *Schwagerina heineri* Petocz, n. sp.

Specimens		Axial Sections								
		UA2146	UA2147	UA2148	UA2149	UA2150	UA2151	UA2152	UA2153	UA2154
	1	.07	.07	.13	.13	-	.10	.16	.10	.10
	2	.14	.17	.20	.25	.31	.21	.29	.23	.20
HL	3	.30	.35	.46	.36	.59	.56	.60	.41	.41
	4	.56	.72	.79	-	.90	-	1.13	.81	.63
	5	1.02	1.14	1.70	-	1.59	-	1.46	1.53	1.06
	6	1.68	1.93	2.65	1.90	-	1.58	2.10	2.08	-
	7	2.54	2.41	3.29	-	-	-	-	2.81	-
	8	-	-	-	-	-	-	-	3.40	-
	1	.07	.08	.09	.08	.09	.09	.10	.07	.07
	2	.11	.12	.15	.13	.15	.13	.15	.10	.11
RV	3	.18	.15	.21	.19	.23	.18	.24	.17	.17
	4	.26	.24	.30	.29	.39	.26	.35	.25	.27
	5	.38	.40	.55	.49	.60	.44	.57	.38	.44
	6	.73	.66	.90	.78	-	.62	1.03	.56	-
	7	1.18	1.16	1.43	-	-	-	-	..97	-
	8	-	-	-	-	-	-	-	1.42	-
	1	12.1	16.5	17.6	11.0	17.6	12.1	14.3	9.9	7.7
	2	14.3	16.5	27.0	14.3	22.0	16.5	15.4	12.7	-
PT	3	30.3	18.2	23.1	17.1	30.3	17.6	31.9	22.0	17.6
	4	26.4	25.3	47.9	61.6	41.3	26.4	57.8	24.8	23.1
	5	30.3	29.6	47.9	61.6	44.0	49.5	71.5	26.4	-
	6	-	77.6	62.2	88.0	-	-	-	50.6	-
	7	69.9	-	86.9	-	-	-	-	78.7	-
	8	-	-	-	-	-	-	-	71.0	-

Table 10b, Part 1. Measurements of _Schwagerina heineri_ Petocz, n. sp.

		Axial Sections								
Specimens		UA2146	UA2147	UA2148	UA2149	UA2150	UA2151	UA2152	UA2153	UA2154
	0	-	-	-	.03	.03	-	-	-	.03
	1	.03	.05	.04	.03	.04	.03	.05	.04	.03
TW	2	.04	.07	-	.04	.08	.04	.08	.05	.04
	3	.08	.12	.08	.09	.13	.08	.12	.11	.08
	4	-	-	-	-	-	-	-	.29	.16
	5	-	-	-	-	-	-	-	-	-
	1	.88	.91	1.41	1.55	-	1.11	1.54	1.41	1.33
	2	1.27	1.46	1.39	1.95	2.07	1.64	1.89	2.20	1.88
FR	3	1.68	2.26	2.21	1.87	2.51	3.04	2.50	2.43	2.38
	4	2.16	2.96	2.60	-	2.32	-	3.19	3.24	2.31
	5	2.67	2.88	3.06	-	2.65	-	2.56	3.96	2.43
	6	2.30	2.93	2.95	2.43	-	2.56	2.05	3.68	-
	7	2.15	2.07	2.29	-	-	-	-	2.89	-
	8	-	-	-	-	-	-	-	2.39	-
	1	48.5	53.8	65.3	58.5	63.7	45.7	50.2	49.6	45.5
	2	58.9	32.7	41.9	50.2	55.4	42.3	54.7	60.4	59.2
TS	3	46.6	57.3	47.1	49.2	65.3	41.7	48.4	48.3	59.4
	4	47.2	62.6	81.8	70.6	54.4	68.7	61.0	55.1	59.0
	5	91.3	65.8	61.6	59.8	-	39.1	80.0	46.6	-
	6	61.6	76.4	59.4	-	-	-	-	72.1	-
	7	-	-	-	-	-	-	-	46.1	-
	8									
Pro.	Max.	78.7	105.6	86.9	81.4	112.2	110.0	89.7	100.7	111.1
	Min.	73.2	101.8	84.2	77.0	106.7	101.8	75.9	89.7	101.8

Table 10b, Part 2. Measurements of Schwagerina heineri Petocz, n. sp.

Specimens		Axial Sections UA2155	UA2156	UA2157	UA2158	UA2159	UA2160	UA2161	UA2162	UA2163
HL	1	.10	.10	.13	.08	.07	.11	.08	.15	.08
	2	.26	.23	.17	.16	.17	.24	.19	.48	.18
	3	.52	.45	.31	.32	.42	.51	.38	.68	.40
	4	.81	.75	.62	.60	.85	1.10	.65	1.21	.84
	5	1.31	1.00	1.06	1.01	1.42	1.45	-	1.79	1.49
	6	1.92	1.71	1.96	1.73	2.41	2.03	-	-	1.86
	7	-	2.71	2.77	2.44	-	-	-	-	-
	8	-	3.49	-	3.11	-	-	-	-	-
RV	1	.08	.08	.07	.08	.08	.11	.06	.10	.08
	2	.12	.13	.10	.10	.12	.17	.10	.14	.12
	3	.21	.19	.14	.16	.19	.26	.16	.22	.17
	4	.31	.30	.23	.25	.28	.39	.26	.34	.27
	5	.49	.47	.35	.41	.42	.64	-	.57	.44
	6	.79	.87	.59	.68	.71	1.06	-	-	.71
	7	-	1.29	1.04	1.06	-	-	-	-	-
	8	-	1.74	-	-	-	-	-	-	-
PT	1	9.4	12.1	13.8	9.4	11.0	13.8	11.6	-	11.0
	2	12.1	14.9	12.1	11.0	17.1	19.8	14.9	23.7	25.9
	3	25.3	-	20.4	13.8	31.9	17.6	-	27.5	31.4
	4	25.9	23.7	43.5	24.8	25.3	46.2	42.4	35.2	53.9
	5	35.2	38.5	53.4	49.5	47.3	59.4	-	47.9	64.9
	6	53.4	80.3	73.2	63.3	58.3	-	-	-	-
	7	-	75.9	71.0	79.8	-	-	-	-	-
	8	-	91.3	-	-	-	-	-	-	-

Table 10c, Part 1. Measurements of Schwagerina heineri Petocz, n. sp.

Specimens		Axial Sections UA2155	UA2156	UA2157	UA2158	UA2159	UA2160	UA2161	UA2162	UA2163
	0	.02	.02	-	-	.04	-	.03	-	-
	1	.03	.02	.03	-	.05	.04	.06	.04	.03
TW	2	.05	.03	.04	.05	.08	.07	-	.07	.04
	3	.12	.08	.13	.11	.19	.10	.11	.12	.08
	4	-	.22	-	.12	.41	-	-	.28	-
	5	-	-	-	-	-	-	-	-	-
	1	1.27	1.15	1.75	1.03	.86	.98	1.43	1.53	.98
	2	2.09	1.87	1.68	1.50	1.41	1.41	1.97	3.36	1.47
FR	3	2.44	2.34	2.18	1.97	2.18	1.97	2.35	3.00	2.33
	4	2.58	2.51	2.66	2.38	2.99	2.83	2.46	3.59	3.07
	5	2.67	2.11	3.02	2.49	3.39	2.26	-	3.16	3.37
	6	2.43	1.97	3.30	2.56	3.42	1.92	-	-	2.62
	7	-	2.10	2.66	2.30	-	-	-	-	-
	8	-	2.01	-	-	-	-	-	-	-
	1									
	2	57.1	45.6	38.8	37.0	46.5	55.4	60.7	42.3	49.7
TS	3	75.6	52.6	41.9	54.8	57.7	51.7	69.1	56.9	43.5
	4	46.0	55.9	62.1	53.9	46.7	49.1	61.0	49.3	58.6
	5	57.3	59.5	48.9	61.9	47.4	64.4	-	68.7	60.9
	6	60.0	83.4	70.3	66.2	67.9	65.2	-	-	60.4
	7	-	48.1	75.1	57.1	-	-	-	-	-
	8	-	34.7	-	-	-	-	-	-	-
Pro.	Max.	101.8	93.0	77.6	99.6	106.2	99.0	82.5	99.6	137.5
	Min.	88.6	89.7	75.9	95.7	83.6	77.6	61.6	83.6	116.1

Table 10c, Part 2. Measurements of Schwagerina heineri Petocz, n. sp.

		Axial Sections							
Specimens		UA2164	UA2165	UA2166	UA2167	UA2168	UA2169	UA2170	UA2171
	1	.14	.11	.07	.07	.10	.12	.08	.10
	2	-	.25	.25	.16	.22	.19	.23	.19
HL	3	.59	.45	.32	.31	.52	.45	.41	.46
	4	.94	.65	.63	.46	.78	.84	.76	.75
	5	1.47	1.00	1.08	.69	1.13	1.33	.105	1.06
	6	2.09	-	-	1.20	1.68	1.84	1.66	1.54
	7	-	-	-	1.70	2.50	-	2.49	2.49
	8	-	-	-	2.29	3.51	-	3.64	-
	1	.08	.08	.06	.05	.06	.08	.08	.06
	2	.14	.11	.10	.09	.09	.12	.12	.10
RV	3	.21	.16	.15	.13	.14	.19	.20	.15
	4	.35	.24	.25	.19	.24	.27	.31	.25
	5	.57	.37	.39	.28	.34	.42	.48	.36
	6	.99	-	-	.43	.53	.75	.75	.57
	7	-	-	-	.62	.92	-	1.23	.99
	8	-	-	-	.94	-	-	-	-
	1	18.2	8.3	11.0	11.6	8.8	11.0	13.8	11.6
	2	16.5	9.9	11.0	15.4	11.6	12.1	20.4	12.1
PT	3	34.7	17.1	15.4	-	12.7	20.4	-	18.7
	4	53.4	23.7	29.7	26.4	22.0	22.0	29.2	33.6
	5	61.1	-	-	40.7	20.9	50.6	50.1	37.4
	6	-	-	-	54.5	37.4	97.4	75.9	62.7
	7	-	-	-	46.8	-	-	91.3	-
	8	-	-	-	69.3	-	-	-	-

Table 10d, Part 1. Measurements of Schwagerina heineri Petocz, n. sp.

Specimens		Axial Sections UA2164	UA2165	UA2166	UA2167	UA2168	UA2169	UA2170	UA2171
TW	0	-	-	.03	.02	.02	.02	.03	.02
	1	.04	.04	.03	.03	.02	.04	.03	.04
	2	.07	.06	.08	.06	.06	.07	.05	.06
	3	.12	.09	.14	.11	.07	.12	.11	.10
	4	.26	.26	-	.16	-	-	-	.19
	5	-	-	-	.31	-	-	-	-
FR	1	1.78	1.38	1.24	1.21	1.75	1.55	1.08	1.69
	2	-	2.17	2.57	1.80	2.49	1.63	1.87	1.94
	3	2.78	2.76	2.11	2.46	3.59	2.36	2.10	2.99
	4	2.71	2.69	2.53	2.36	3.29	3.10	2.47	3.03
	5	2.59	2.73	2.79	2.49	3.38	3.17	2.16	2.96
	6	2.11	-	-	2.80	3.17	2.46	2.22	2.68
	7	-	-	-	2.74	2.72	-	2.02	2.50
	8	-	-	-	2.42	-	-	-	-
TS	1	71.5	44.0	61.3	60.1	47.4	48.6	54.7	65.6
	2	55.4	44.7	57.0	44.6	64.3	61.6	59.9	58.0
	3	64.6	47.1	62.2	53.3	62.4	43.8	56.9	62.4
	4	62.7	51.9	54.7	43.9	42.2	54.3	57.0	43.8
	5	74.7	-	-	53.4	57.7	78.7	53.7	60.9
	6	-	-	-	44.8	73.5	-	65.1	73.5
	7	-	-	-	51.7	-	-	-	-
	8								
Pro.	Max	116.1	108.9	66.0	75.9	73.2	108.4	71.5	75.9
	Min.	105.6	100.1	62.7	58.3	70.4	97.9	55.6	68.2

Table 10d, Part 2. Measurements of <u>Schwagerina</u> <u>heineri</u> Petocz, n. sp.

		Sagittal Sections					
Specimens		UA2172	UA2173	UA2174	UA2175	UA2176	UA2177
RV	1	.071	.076	.084	.046	.095	.086
	2	.109	.112	.133	.068	.132	.139
	3	.156	.273	.204	.083	.218	.252
	4	.252	.408	.316	.133	.336	.377
	5	.418	.638	.574	.194	.562	.504
	6	.677	-	.942	.292	.917	1.070
	7	-	-	-	.437	-	1.598
	8	-	-	-	.670	-	-
PT	1	8.3	-	8.3	12.1	11.6	13.8
	2	-	12.1	9.4	22.0	12.7	-
	3	15.4	17.6	12.7	22.0	22.6	47.3
	4	30.8	17.6	24.8	19.3	30.8	66.6
	5	35.2	28.1	40.0	46.8	46.8	89.1
	6	-	47.9	50.0	-	-	112.8
	7	-	-	-	48.4	-	-
SC	1	7	-	9	9	12	12
	2	12	13	15	-	15	14
	3	16	17	18	-	18	15
	4	18	-	21	22	20	20
	5	21	20	22	27	-	24
	6	23	27	30	29	31	32
	7	-	-	-	36	-	41
Pro.	Max.	66.0	81.4	83.6	113.9	107.8	-
	Min.	55.0	68.8	81.4	104.0	-	-

Table 10e. Measurements of _Schwagerina_ _heineri_ Petocz, n. sp.

Specimens		Axial Sections					
		UA2128	UA2129	UA2130	UA2131	UA2132	UA2133
	1	.15	.13	.08	.18	.20	.22
	2	-	.30	.24	.38	.41	.52
HL	3	.74	.50	.36	.91	.96	.81
	4	1.06	.93	-	1.44	1.68	1.28
	5	1.97	1.44	1.59	2.67	2.69	2.03
	6	3.12	2.41	2.28	-	3.52	-
	7	4.22	3.64	3.79	-	5.63	-
	8	-	4.59	-	-	-	-
	1	.10	.12	.09	.10	.13	.12
	2	.14	.18	.14	.16	.18	.18
RV	3	.21	.30	.21	.26	.26	.27
	4	.33	.45	.30	.42	.42	.44
	5	.45	.74	.46	.62	.63	.69
	6	.77	1.11	.74	-	.96	-
	7	-	-	1.33	-	1.36	-
	1	17.1	12.1	13.8	11.0	13.8	19.3
	2	19.3	13.2	29.2	13.2	18.7	20.9
PT	3	26.4	34.7	31.4	16.5	42.9	34.1
	4	30.8	57.8	-	33.6	55.0	-
	5	39.1	67.7	88.0	53.9	64.4	-
	6	83.1	97.9	-	66.6	83.6	-
	7	-	109.5	-	97.4	-	-

Table 11a, Part 1. Measurements of Schwagerina moffiti Petocz, n. sp.

Specimens		Axial Sections: UA2128	UA2129	UA2130	UA2131	UA2132	UA2133
TW	0	.04	-	.02	.04	.04	-
	1	.05	.05	.03	.07	.08	-
	2	.08	.06	.08	.11	.10	-
	3	.10	.08	.09	.14	.19	-
	4	.22	-	.20	.39	-	-
	5	.32	-	-	-	-	-
FR	1	1.53	1.10	.95	1.82	1.60	1.83
	2	-	1.71	1.66	2.29	2.32	2.87
	3	3.49	1.65	1.72	3.53	3.67	2.99
	4	3.42	2.07	-	3.40	4.00	2.92
	5	4.32	1.94	3.45	4.33	4.27	2.93
	6	4.06	2.16	3.09	-	3.66	-
	7	-	-	2.86	-	4.15	-
TS	1						
	2	39.6	52.4	64.6	63.4	41.3	49.4
	3	51.1	70.3	48.0	56.6	48.9	48.2
	4	53.8	48.3	41.3	63.7	59.9	61.1
	5	38.8	65.1	54.8	45.8	49.9	58.7
	6	68.8	49.6	59.9	-	52.6	-
	7	-	-	79.6	-	41.2	-
Pro.	Max.	161.7	-	116.1	189.8	175.5	-
	Min.	150.7	-	110.6	155.1	152.9	-

Table 11a, Part 2. Measurements of Schwagerina moffiti Petocz, n. sp.

Specimen		Sagittal Section UA2134
RV	1	.163
	2	.249
	3	.360
	4	.616
	5	.989
PT	1	14.9
	2	24.8
	3	36.9
	4	55.0
	5	63.3
SC	1	14
	2	18
	3	23
	4	24
	5	36
Pro.	Max.	178.2
	Min.	152.4

Table 11b. Measurements of *Schwagerina moffiti* Petocz, n. sp.

		Axial Sections		
Specimens		UA2195	UA2196	UA2197
	1	.10	.07	.07
	2	.24	.16	.21
HL	3	.36	.31	.36
	4	.57	.56	.66
	5	1.04	.97	1.07
	6	1.51	1.49	2.04
	7	2.78	-	-
	8	3.69	-	-
	1	.07	.07	.06
	2	.10	.10	.10
RV	3	.14	.15	.15
	4	.20	.22	.22
	5	.32	.36	.34
	6	.48	.63	.62
	7	.69	-	-
	8	1.09	-	-
	1	9.9	8.3	8.8
	2	13.2	13.8	9.4
PT	3	21.5	14.9	14.3
	4	24.2	30.3	26.4
	5	49.0	42.9	37.4
	6	38.0	48.4	59.4
	7	51.7	-	-
	8	71.5	-	-

Table 12, Part 1. Measurements of _Schwagerina_ sp. B

Specimens		Axial Sections UA2195	UA2196	UA2197
TW	0	-	-	-
	1	.04	.04	.03
	2	.08	.05	.04
	3	.13	.10	.09
	4	.30	-	.12
	5	.40	-	-
FR	1	1.48	.90	1.13
	2	2.38	1.60	2.11
	3	2.52	2.10	2.44
	4	2.81	2.50	3.00
	5	3.20	2.69	3.15
	6	3.18	2.36	3.29
	7	4.04	-	-
	8	3.39	-	-
TS	1	43.8	40.0	68.6
	2	45.7	45.9	48.8
	3	41.2	48.6	51.0
	4	59.2	61.5	53.1
	5	46.5	75.4	83.3
	6	44.4	-	-
	7	58.0	-	-
	8			
Pro.	Max.	101.2	73.7	83.1
	Min.	81.4	73.2	70.4

Table 12, Part 2. Measurements of *Schwagerina* sp. B

Specimens		Axial Sections UA2198	UA2199	UA2200
	1	.14	.15	.09
	2	.37	.28	.22
HL	3	.57	.58	.40
	4	.95	.89	.61
	5	1.45	1.34	.95
	6	1.85	2.40	1.82
	7	-	3.34	2.48
	1	.10	.08	.08
	2	.14	.13	.13
RV	3	.21	.22	.19
	4	.32	.34	.30
	5	.43	.49	.42
	6	.53	.70	.56
	7	-	1.01	.83
	1	15.4	14.3	12.7
	2	17.6	14.9	14.3
PT	3	20.9	26.4	23.1
	4	19.3	34.7	24.8
	5	23.1	34.7	35.8
	6	30.3	44.0	40.7
	7	-	71.0	74.8

Table 13, Part 1. Measurements of Schwagerina sp. C

Specimens		UA2198	UA2199	UA2200
		Axial Sections		
TW	0	.04	-	.03
	1	.05	.06	.04
	2	.10	.06	.11
	3	.14	-	.21
	4	-	-	-
	5	-	.36	-
FR	1	1.38	1.76	1.14
	2	2.60	2.24	1.79
	3	2.63	2.62	2.03
	4	2.99	2.62	2.03
	5	3.36	2.75	2.23
	6	3.46	3.41	3.24
	7	-	3.30	2.97
TS	1	43.5	48.7	60.5
	2	50.1	74.5	56.2
	3	47.4	52.7	53.3
	4	36.1	43.9	42.2
	5	23.4	44.0	31.8
	6	-	43.7	48.4
	7			
Pro.	Max.	147.4	116.6	116.6
	Min.	115.0	107.3	104.5

Table 13, Part 2. Measurements of <u>Schwagerina</u> sp. C

Specimens		Axial Sections UA2205	UA2206	UA2207	UA2208	UA2209	UA2210	UA2211
	1	.17	.24	.26	.30	.31	.22	-
	2	.34	.48	.50	-	.57	.43	.75
HL	3	.60	.84	.88	.71	.97	.72	1.19
	4	.89	1.57	1.35	-	1.71	1.13	1.73
	5	1.41	2.77	2.27	2.39	3.57	1.48	3.45
	6	2.14	3.59	3.44	4.01	4.54	2.51	5.40
	7	3.38	4.98	5.20	5.24	-	3.30	-
	8	5.15	-	-	-	-	-	-
	1	.12	.14	.15	.15	.12	.15	.17
	2	.16	.23	.23	.25	.19	.20	.24
RV	3	.23	.32	.33	.33	.29	.28	.37
	4	.34	.47	.48	.45	.41	.38	.56
	5	.51	.69	.73	.69	.66	.57	.78
	6	.74	1.05	1.09	1.04	1.14	.78	1.23
	7	1.13	-	-	-	-	-	-
	8	1.63	-	-	-	-	-	-
	1	12.7	22.0	26.4	12.7	18.2	-	14.9
	2	17.1	29.2	28.6	34.7	18.2	19.3	19.3
PT	3	20.9	31.4	37.4	34.7	24.2	27.5	20.9
	4	-	35.2	42.4	41.3	53.9	30.3	31.9
	5	45.7	41.8	67.1	63.8	73.2	45.1	39.6
	6	53.9	89.7	64.9	77.6	106.8	46.8	-
	7	87.5	-	-	-	-	-	-

Table 14a, Part 1. Measurements of Schwagerina rainyensis Petocz, n. sp.

		Axial Sections						
Specimens		UA2205	UA2206	UA2207	UA2208	UA2209	UA2210	UA2211
	0	-	-	-	-	-	-	.03
	1	-	.07	.08	.06	-	-	.08
TW	2	-	.10	.08	.06	-	-	.19
	3	.03	.14	-	.10	-	-	-
	4	-	-	-	.30	-	-	-
	1	1.40	1.64	1.78	1.94	2.62	1.49	-
	2	2.11	2.11	2.15	-	2.92	2.15	3.06
FR	3	2.63	2.62	2.67	2.13	3.38	2.60	3.23
	4	2.64	3.36	2.80	-	4.19	2.95	3.10
	5	2.79	4.02	3.13	3.46	5.42	2.59	4.43
	6	2.88	3.42	3.14	3.85	3.97	3.23	4.40
	7	3.00	-	-	-	-	-	-
	8	3.16	-	-	-	-	-	-
	1	32.8	57.2	57.4	61.6	65.6	35.8	47.2
	2	43.7	40.7	41.8	34.2	46.5	38.8	51.0
TS	3	48.0	45.9	46.3	34.5	43.2	37.3	51.4
	4	50.6	47.8	51.1	53.5	60.8	48.9	39.2
	5	47.0	52.2	50.5	50.5	73.2	36.2	57.8
	6	51.6	-	-	-	-	-	-
	7	44.4	-	-	-	-	-	-
	8							
Pro.	Max.	187.0	221.7	227.7	172.2	160.6	180.4	226.6
	Min.	154.0	202.4	-	138.6	-	-	215.6

Table 14a, Part 2. Measurements of Schwagerina rainyensis Petocz, n. sp.

		Sagittal Section
Specimen		UA2217
RV	1	.116
	2	.160
	3	.253
	4	.385
	5	.556
	6	.789
	7	1.125
PT	1	15.4
	2	13.8
	3	22.0
	4	26.4
	5	44.0
	6	50.1
	7	64.4
SC	1	-
	2	-
	3	24
	4	28
	5	32
	6	42
	7	42
Pro.	Max.	146.9
	Min.	122.7

Table 14b. Measurements of Schwagerina rainyensis Petocz, n. sp.

Specimens		Axial Sections UA2218	UA2219	UA2220	UA2221	UA2222	UA2223	UA2224	UA2225
	1	.25	.13	.21	.19	.22	.25	.17	.14
	2	.61	.36	.37	.47	.46	.45	.41	.42
HL	3	1.10	.80	.69	.98	.90	.78	.78	.81
	4	1.72	1.28	1.37	1.24	1.47	1.34	1.43	1.54
	5	3.08	2.03	2.35	1.89	2.51	2.46	2.55	2.76
	6	4.98	2.97	4.33	2.67	-	-	4.17	3.90
	7	5.50	4.89	-	4.35	-	-	-	5.07
	1	.15	.12	.11	.12	.12	.13	.10	.08
	2	.22	.19	.18	.18	.20	.21	.17	.13
RV	3	.31	.27	.28	.26	.32	.33	.29	.23
	4	.45	.38	.47	.40	.50	.52	.42	.35
	5	.65	.54	.74	.57	.75	.75	.68	.62
	6	.94	.80	1.06	.83	-	-	1.09	.89
	7	1.31	1.11	-	-	-	-	-	-
	1	14.9	11.0	15.4	13.8	14.9	19.8	16.5	12.1
	2	18.2	17.1	20.9	19.8	27.0	20.9	24.8	17.1
PT	3	46.2	26.4	38.5	31.9	43.5	41.3	42.4	35.2
	4	54.5	34.7	46.2	41.3	42.4	48.4	36.9	53.4
	5	41.3	38.5	62.2	60.5	67.7	61.6	52.3	66.0
	6	67.7	72.6	68.8	66.6	-	-	63.3	102.2

Table 15a, Part 1. Measurements of Schwagerina mankomenensis Petocz, n. sp.

		Axial Sections							
Specimens		UA2218	UA2219	UA2220	UA2221	UA2222	UA2223	UA2224	UA2225
	0	.03	.04	.04	.03	.03	.04	.04	.03
	1	.07	.05	.05	.05	.06	.06	.07	.04
TW	2	.10	.10	.11	.11	.19	.12	.12	.10
	3	.23	-	.37	.14	.21	-	-	-
	4	.38	-	-	-	.29	-	.35	-
	5	.66	-	-	-	.56	-	-	-
	1	1.61	1.08	1.88	1.60	1.88	1.83	1.70	1.61
	2	2.82	1.94	2.04	2.59	2.23	2.11	2.40	3.09
FR	3	3.57	2.97	2.43	3.72	2.79	2.38	2.66	3.58
	4	3.84	3.40	2.89	3.06	2.92	2.56	3.35	4.41
	5	4.74	3.74	3.17	3.31	3.36	3.29	3.74	4.48
	6	5.28	3.72	4.08	3.22	-	-	3.84	4.35
	7	4.21	4.39	-	-	-	-	-	-
	1	41.7	53.5	63.9	49.1	71.9	58.1	64.9	57.0
	2	41.3	43.9	56.3	45.2	58.8	53.8	72.9	68.0
TS	3	46.3	40.1	68.5	54.1	54.6	59.4	45.2	54.6
	4	44.5	44.0	56.4	41.0	48.8	43.1	60.2	76.0
	5	45.2	47.5	42.8	45.0	-	-	59.2	45.3
	6	38.5	39.4	-	-	-	-	-	-
	7								
Pro.	Max.	173.3	194.2	162.8	162.8	181.5	153.5	151.8	143.6
	Min.	162.8	161.2	162.8	160.6	152.9	136.4	127.6	114.4

Table 15a, Part 2. Measurements of Schwagerina mankomenensis Petocz, n. sp.

		Sagittal Sections	
Specimens		UA2226	UA2227
RV	1	.177	.201
	2	.260	.322
	3	.398	.510
	4	-	.714
	5	-	1.065
PT	1	25.3	20.9
	2	23.1	29.7
	3	36.3	44.6
	4	-	45.1
	5	-	54.5
SC	1	13	13
	2	19	18
	3	22	22
	4	26	25
	5	-	33
Pro.	Max.	198.0	228.3
	Min.	183.7	215.6

Table 15b. Measurements of Schwagerina mankomenensis Petocz, n. sp.

		Axial Sections								
Specimens		UA2230	UA2231	UA2232	UA2233	UA2234	UA2235	UA2236	UA2237	UA2238
	1	.21	.20	.23	.21	.22	.20	.21	.11	.22
	2	.39	.50	.46	.52	.40	.40	.44	.36	.54
HL	3	.60	.89	.68	1.06	.85	.68	.92	.69	.90
	4	-	-	.92	1.72	1.36	1.40	1.60	1.41	1.30
	5	2.13	2.26	1.62	3.46	3.18	2.00	3.02	1.97	3.09
	6	3.27	3.94	2.88	5.37	4.73	3.06	4.13	4.28	4.32
	7	4.60	5.00	4.43	-	5.67	4.69	-	-	5.37
	8	-	-	-	-	-	6.59	-	-	-
	1	.11	.11	.11	.15	.10	.12	.11	.10	.11
	2	.17	.18	.16	.18	.17	.18	.17	.17	.19
RV	3	.26	.31	.27	.29	.26	.26	.28	.26	.32
	4	.38	.45	.46	.46	.38	.38	.42	.40	.51
	5	.67	.72	[illegible]	.78	.64	.56	.64	.63	.82
	6	1.01	1.06	.93	1.30	.93	.83	1.05	.99	1.24
	7	1.44	1.43	1.42	-	1.39	1.25	-	-	1.78
	8	-	-	1.67	-	-	1.67	-	-	-
	1	17.6	18.7	16.5	16.5	13.8	12.7	14.3	16.0	18.2
	2	17.6	16.5	24.8	22.0	23.7	31.4	18.2	17.1	22.0
PT	3	23.1	28.1	-	28.1	25.9	38.5	33.6	24.8	43.5
	4	34.1	34.1	40.2	41.8	36.9	44.0	47.3	42.4	53.9
	5	58.3	52.8	52.3	61.6	61.6	47.9	51.7	44.6	103.5
	6	71.5	113.4	69.3	78.1	59.4	60.0	95.2	90.8	135.9
	7	-	112.3	97.9	-	-	86.9	94.[illegible]	-	-
	8	-	-	109.0	-	-	127.1	-	-	-

Table 16a, Part 1. Measurements of Schwagerina hyperborea (Salter)

Specimens		Axial Sections UA2230	UA2231	UA2232	UA2233	UA2234	UA2235	UA2236	UA2237	UA2238
TW	0	.03	-	.04	.06	.03	.04	.03	.04	.04
	1	.06	.07	.06	.07	.07	.08	.14	.04	.07
	2	.14	.11	.08	.13	.09	.09	.08	.06	-
	3	.11	-	.14	-	.14	.13	.24	-	-
	4	-	-	.22	-	-	-	.48	-	-
	5	-	-	.36	-	-	-	-	-	-
	6	-	-	.79	-	.73	-	-	-	-
FR	1	1.93	1.78	2.13	1.43	2.21	1.68	1.80	1.13	2.00
	2	2.30	2.76	2.76	2.87	2.39	2.29	2.53	2.13	2.89
	3	2.26	2.90	2.48	3.72	3.31	2.66	3.32	2.63	2.79
	4	-	-	2.00	3.73	3.58	3.62	3.77	3.53	2.54
	5	3.18	3.15	2.55	4.42	4.95	3.56	4.72	3.15	3.78
	6	3.23	3.71	3.09	4.12	5.07	3.67	3.92	4.33	3.48
	7	3.19	3.51	3.11	-	4.09	3.73	-	-	3.01
	8	-	-	-	-	-	3.95	-	-	-
TS	1									
	2	53.0	65.0	52.6	22.7	64.3	45.4	51.7	69.0	67.7
	3	55.6	69.1	66.8	56.4	54.7	45.3	58.0	55.7	71.7
	4	43.8	46.9	67.2	61.6	48.5	50.2	53.5	52.8	58.9
	5	76.9	58.0	38.3	69.3	68.8	46.1	51.0	57.3	59.9
	6	50.6	47.9	46.5	66.3	44.9	47.8	64.5	57.7	51.7
	7	42.8	34.4	52.6	-	48.5	50.6	-	-	43.6
Pro.	Max.	157.3	163.9	163.4	227.2	149.1	209.6	160.6	145.8	173.8
	Min.	135.3	133.7	130.9	177.7	134.2	176.0	149.6	128.2	144.1

Table 16a, Part 2. Measurements of Schwagerina hyperborea (Salter)

Specimens		Sagittal Sections UA2239	UA2240	UA2241
RV	1	.135	.160	.132
	2	.207	.218	.215
	3	.295	.312	.347
	4	.422	.484	.522
	5	.636	.725	.811
	6	.929	1.030	1.262
	7	-	1.474	-
PT	1	14.3	12.7	12.1
	2	16.5	16.0	14.9
	3	31.4	28.1	-
	4	24.8	47.9	33.0
	5	48.4	56.1	49.5
	6	61.1	88.6	64.9
	7	-	99.0	-
SC	1	11	11	-
	2	20	18	19
	3	26	23	22
	4	24	21	25
	5	27	27	24
	6	31	29	32
Pro.	Max.	145.8	178.8	-
	Min.	132.6	170.5	-

Table 16b. Measurements of Schwagerina hyperborea (Salter)

		Axial Sections								
Specimens		UA2244	UA2245	UA2246	UA2247	UA2248	UA2249	UA2250	UA2251	UA2252
	1	.31	.22	.36	.43	.22	.16	.40	.30	.17
	2	.68	.75	.73	.88	.48	.39	.82	.69	.40
HL	3	1.17	1.34	1.47	1.32	.86	.83	1.34	.94	.86
	4	2.03	2.20	2.04	2.13	1.51	1.28	1.95	1.48	1.56
	5	2.81	3.28	2.89	2.70	2.19	1.85	2.58	1.89	2.50
	6	-	4.64	3.69	3.69	3.29	2.57	3.63	2.67	3.48
	7	5.68	6.38	-	-	4.45	3.63	-	3.70	4.62
	8	6.81	-	-	-	-	-	-	-	-
	1	.21	.15	.19	.23	.18	.13	.23	.15	.21
	2	.33	.23	.32	.35	.27	.19	.33	.22	.28
RV	3	.39	.34	.48	.47	.36	.28	.46	.32	.41
	4	.53	.51	.59	.65	.50	.40	.59	.36	.55
	5	.71	.62	-	.91	.69	.56	-	.61	.75
	6	.95	.97	1.00	1.14	.88	.75	1.00	.79	-
	7	1.32	-	-	-	1.18	1.05	-	1.05	1.39
	8	1.49	-	-	-	-	-	-	1.40	-
	1	12.7	20.4	16.5	34.1	16.5	15.4	24.2	14.3	18.2
	2	24.2	27.5	35.2	38.0	39.1	20.9	47.3	31.9	21.5
PT	3	35.2	-	60.5	34.1	47.3	35.8	47.9	39.1	51.7
	4	42.9	56.1	60.0	44.0	55.0	44.0	35.8	39.6	51.7
	5	58.3	70.4	62.2	62.2	67.1	48.4	-	46.8	57.8
	6	64.9	84.7	-	73.7	90.8	73.2	61.6	53.9	69.3
	7	100.7	-	-	-	99.0	85.8	-	54.5	84.7
	8	80.3	-	-	-	-	-	-	84.2	-

Table 17a, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

		Axial Sections								
Specimens		UA2244	UA2245	UA2246	UA2247	UA2248	UA2249	UA2250	UA2251	UA2252
TW	0	.07	.08	.10	.15	.07	.06	-	.09	.05
	1	.14	.14	.20	.33	.16	.14	-	.14	.14
	2	.22	.26	-	.57	.36	-	.51	.32	.52
	3	.86	.48	1.10	1.28	.97	.77	.94	-	.70
	4	1.27	-	1.06	-	1.02	-	-	-	-
	5	1.48	1.51	-	-	2.00	-	-	-	-
	6	1.69	-	-	-	2.19	-	-	1.75	-
FR	1	1.48	1.42	1.84	1.83	1.22	1.25	1.69	1.95	.81
	2	2.04	3.23	2.27	2.51	1.80	2.03	2.46	3.12	1.42
	3	3.00	3.90	3.06	2.83	2.40	2.95	2.88	2.93	2.11
	4	3.82	4.34	3.45	3.24	3.01	3.21	3.28	4.15	2.80
	5	3.96	5.27	-	2.96	3.18	3.28	-	3.08	3.31
	6	-	4.78	3.69	3.24	3.72	3.44	3.62	3.38	-
	7	4.30	-	-	-	3.76	3.46	-	3.51	3.33
	8	4.57	-	-	-	-	-	-	-	-
TS	1	56.4	51.9	65.0	50.1	50.9	46.8	42.9	44.6	32.4
	2	17.8	48.4	49.6	32.6	32.4	45.3	38.8	44.9	43.3
	3	36.3	47.6	23.4	40.4	41.2	42.6	27.9	11.1	36.8
	4	33.5	22.8	-	39.4	36.6	41.2	-	72.2	35.7
	5	34.5	55.7	-	24.7	28.6	32.7	-	28.6	-
	6	38.5	-	-	-	33.9	40.4	-	32.9	-
	7	12.9	-	-	-	-	-	-	32.6	-
	8									
Pro.	Max.	278.3	212.3	262.9	260.7	219.5	192.5	257.4	237.6	293.2
	Min.	241.5	177.1	261.3	226.1	201.9	159.0	215.1	191.4	243.7

Table 17a, Part 2. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		Axial Sections								
		UA2253	UA2254	UA2255	UA2256	UA2257	UA2258	UA2259	UA2260	UA2261
	1	.36	.23	.31	.37	.21	.37	.42	.38	.53
	2	.73	.57	.63	.73	.47	.65	.75	.61	-
HL	3	1.21	.95	1.05	1.36	.79	1.01	1.53	.96	2.05
	4	-	1.69	1.58	1.70	1.40	-	2.20	1.39	2.91
	5	-	2.56	2.43	3.53	2.18	4.25	3.08	2.26	-
	6	-	3.42	3.22	4.84	-	5.42	4.81	3.53	-
	7	-	5.22	-	-	5.22	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
	1	-	.16	.21	.14	.13	.18	.22	.18	.26
	2	.32	.24	.30	.25	.18	.26	.31	.25	.39
RV	3	.45	.33	.43	.36	.28	.37	.47	.35	.55
	4	-	.47	.58	.55	.40	.53	.69	.47	.76
	5	-	.66	.78	.80	.57	.78	-	.71	-
	6	-	.91	1.02	1.11	.75	1.21	-	.94	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
	1	13.8	17.6	23.1	20.4	11.0	19.3	12.1	32.5	22.6
	2	34.1	14.3	20.4	-	11.6	19.3	39.1	18.7	40.7
PT	3	50.6	23.7	41.3	38.5	28.1	20.9	44.0	27.0	55.0
	4	-	24.8	46.2	52.3	35.2	42.9	82.5	35.8	82.5
	5	-	56.7	60.5	72.6	56.1	69.9	-	68.8	-
	6	-	61.1	65.5	84.2	60.5	-	-	53.4	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-

Table 17b, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

		Axial Sections								
Specimens		UA2253	UA2254	UA2255	UA2256	UA2257	UA2258	UA2259	UA2260	UA2261
TW	0	.07	.08	.04	.06	.06	-	.04	.08	-
	1	.16	-	.15	.13	.11	.09	.12	.10	.26
	2	.21	-	.24	.22	.20	.14	.16	.19	.52
	3	-	.63	[illegible]	.31	-	.24	-	.30	.78
	4	-	.77	.53	.71	.59	.37	.55	.71	-
	5	-	1.42	1.11	1.09	-	.72	-	-	-
	6	-	-	-	-	-	-	-	-	-
FR	1	-	1.41	1.51	1.67	2.66	2.03	1.90	2.14	2.03
	2	2.30	2.41	2.07	2.60	2.87	2.49	2.43	2.37	-
	3	2.68	2.85	2.45	2.84	3.77	2.70	3.28	2.75	3.76
	4	-	3.61	2.70	3.47	3.06	-	3.21	2.93	3.83
	5	-	3.88	3.11	3.82	4.41	5.43	-	3.18	-
	6	-	3.75	3.14	-	4.35	4.46	-	3.74	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
TS	1									
	2	-	45.8	48.4	83.7	44.5	41.4	39.5	44.8	49.9
	3	42.5	40.7	40.5	41.4	52.8	42.9	50.1	36.2	38.0
	4	-	40.1	36.3	53.6	45.4	43.4	47.3	36.3	39.0
	5	-	40.6	33.8	43.9	41.1	46.0	-	49.3	-
	6	-	38.3	31.0	39.4	31.5	55.4	-	32.9	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
Pro.	Max.	321.8	-	186.5	211.2	172.2	177.7	218.9	226.6	303.6
	Min.	256.3	-	184.8	155.1	160.6	165.0	183.7	217.8	268.4

Table 17b, Part 2. Measurements of <u>Eoparafusulina (Eoparafusulina) mendenhalli</u> Petocz, n. sp.

		Axial Sections								
Specimens		UA2262	UA2263	UA2264	UA2265	UA2266	UA2267	UA2268	UA2269	UA2270
HL	1	.23	.29	.40	.30	.30	.27	.31	.31	.20
	2	.48	.51	.80	.56	.56	.47	.57	.53	.50
	3	.94	.87	-	1.00	1.00	.89	.98	.97	.82
	4	1.32	1.37	-	-	-	1.42	1.90	-	1.36
	5	-	2.22	3.47	2.49	2.49	2.01	3.24	-	2.40
	6	2.93	3.66	5.03	3.23	3.23	3.00	4.35	3.72	-
	7	4.14	5.15	-	4.72	4.72	4.47	-	-	-
	8	-	-	-	5.99	5.99	5.72	-	-	-
RV	1	.13	.19	.20	.19	.19	.15	.16	.17	.24
	2	.22	.27	.31	.27	.27	.23	.24	.24	.32
	3	.32	.36	.46	.38	.38	.31	.37	.33	.42
	4	.49	.46	.63	.49	.49	.41	.49	.47	.59
	5	.69	.63	.87	.65	.65	.57	.73	.65	.79
	6	-	.84	1.11	.86	.86	.77	1.02	-	-
	7	-	1.05	-	1.10	1.10	1.04	-	-	-
	8	-	-	-	-	-	1.51	-	-	-
PT	1	29.7	30.3	12.1	10.5	10.5	-	-	17.6	23.7
	2	17.6	23.7	29.7	30.3	30.3	-	14.3	19.3	52.3
	3	30.8	31.4	42.4	23.1	23.1	18.7	25.3	19.3	27.5
	4	57.2	39.1	38.0	35.8	35.8	47.3	42.4	28.6	52.8
	5	76.5	55.6	62.2	65.5	65.5	79.8	63.3	46.8	83.6
	6	-	58.9	-	45.1	45.1	81.4	66.6	57.2	-
	7	-	-	-	88.6	88.6	76.5	-	-	-
	8	-	-	-	-	-	-	-	-	-

Table 17c, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		UA2262	UA2263	UA2264	UA2265	UA2266	UA2267	UA2268	UA2269	UA2270
		Axial Sections								
TW	0	.05	.08	.06	.06	.06	.06	.04	.05	-
	1	.10	-	.14	.12	.12	.07	.14	.11	.10
	2	.13	.23	.25	-	-	-	.26	.19	.20
	3	.29	.28	.61	.29	.29	-	.54	.33	.28
	4	.67	.51	.67	.32	.32	.39	1.04	-	.37
	5	.79	.82	1.36	.67	.67	-	-	.96	-
	6	-	1.05	-	1.08	1.08	1.00	-	-	-
FR	1	1.71	1.54	2.00	1.64	1.64	1.82	1.93	1.87	.84
	2	2.20	1.93	2.56	2.07	2.07	2.02	2.35	2.19	1.56
	3	2.94	2.42	-	2.67	2.65	2.86	2.66	2.93	1.95
	4	2.71	2.97	-	-	-	3.44	3.88	-	2.29
	5	-	3.53	4.00	3.81	3.81	3.52	4.42	-	3.04
	6	-	4.33	4.53	3.76	3.76	3.87	4.25	-	-
	7	-	4.91	-	4.30	4.30	4.29	-	-	-
	8	-	-	-	-	-	3.79	-	-	-
TS	1									
	2	60.7	42.7	57.0	46.3	46.3	54.6	51.2	46.4	33.8
	3	47.6	34.3	45.4	37.8	38.8	34.9	50.6	35.7	31.9
	4	52.6	28.7	39.0	31.2	30.3	32.1	33.4	40.8	40.0
	5	41.7	36.4	36.9	32.5	32.5	37.9	49.3	40.4	33.7
	6	-	34.0	27.8	31.4	31.4	35.9	39.7	-	-
	7	-	24.1	-	27.8	27.8	34.5	-	-	-
	8	-	-	-	-	-	44.9	-	-	-
Pro.	Max.	150.7	259.6	240.9	239.3	227.2	220.0	190.3	247.5	299.8
	Min.	147.4	213.4	199.1	196.9	226.6	212.3	187.6	243.7	275.0

Table 17c, Part 2. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		Axial Sections UA2271	UA2272	UA2273	UA2274	UA2275	UA2276	UA2277	UA2278	UA2279
	1	.25	.39	.22	.25	.34	.36	.25	.33	.22
	2	.43	.88	.59	.58	.69	.73	.41	.88	.39
HL	3	.78	1.17	1.04	-	-	1.05	-	1.49	.76
	4	1.28	-	1.89	2.10	2.30	1.42	1.83	2.41	1.36
	5	1.71	-	2.83	2.66	-	-	-	3.63	2.17
	6	-	-	3.87	-	-	-	-	5.25	3.26
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
	1	.17	.22	.19	.15	.24	.17	.13	.16	.13
	2	.22	.33	.27	.23	.34	.25	.20	.25	.19
RV	3	.31	.41	.40	.35	.44	.34	.29	.37	.26
	4	.43	-	.55	.47	.61	.46	.41	.55	.40
	5	.57	-	.72	.64	-	-	-	.81	.56
	6	-	-	1.01	-	-	-	-	1.05	.75
	7	-	-	-	-	-	-	-	-	1.09
	8	-	-	-	-	-	-	-	-	-
	1	12.1	29.7	12.7	20.4	15.4	16.5	13.8	20.4	11.0
	2	12.1	31.4	30.8	23.7	30.3	16.5	20.4	22.6	12.1
PT	3	23.1	40.2	30.3	31.9	55.6	30.3	28.1	38.0	20.9
	4	28.6	-	41.3	49.0	66.6	34.1	35.8	66.6	46.8
	5	38.5	-	36.3	56.7	-	-	-	72.6	59.4
	6	-	-	73.2	-	-	-	-	-	56.7
	7	-	-	-	-	-	-	-	-	80.9
	8	-	-	-	-	-	-	-	-	-

Table 17d, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

		Axial Sections								
Specimens		UA2271	UA2272	UA2273	UA2274	UA2275	UA2276	UA2277	UA2278	UA2279
TW	0	-	.09	-	-	.10	.07	.05	.10	.07
	1	.18	.25	.12	.11	.21	.15	.08	.18	-
	2	-	-	.43	.19	.30	.27	.19	.32	.19
	3	-	-	.40	.35	-	-	.37	-	.33
	4	-	-	.57	.55	-	-	-	1.35	.99
	5	-	-	1.69	-	-	-	-	-	1.01
	6	-	-	-	-	-	-	-	-	.98
FR	1	1.48	1.77	1.16	1.65	1.43	2.09	1.84	2.02	1.67
	2	1.93	2.68	2.20	2.49	2.03	2.89	2.00	3.47	2.04
	3	2.51	2.85	2.63	-	-	3.12	-	3.97	2.85
	4	3.00	-	3.46	4.44	3.76	3.07	4.45	4.36	3.38
	5	3.02	-	3.91	4.17	-	-	-	4.49	3.85
	6	-	-	3.82	-	-	-	-	5.01	4.37
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-
TS	1	32.2	47.5	41.4	54.5	40.1	45.0	51.1	55.9	43.2
	2	40.3	24.9	48.2	49.3	30.2	33.5	41.6	47.8	38.5
	3	36.7	-	38.2	34.8	38.3	37.2	41.3	47.8	51.9
	4	32.5	-	32.2	35.1	-	-	-	46.5	39.9
	5	-	-	39.9	-	-	-	-	29.4	32.1
	6	-	-	-	-	-	-	-	-	46.0
	7	-	-	-	-	-	-	-	-	-
	8									
Pro.	Max.	240.4	276.1	291.5	207.4	275.0	248.6	190.9	232.7	181.5
	Min.	210.7	262.4	255.8	191.4	273.4	227.2	179.9	212.3	155.7

Table 17d, Part 2. Measurements of <u>Eoparafusulina</u> <u>(Eoparafusulina)</u> <u>mendenhalli</u> Petocz, n. sp.

Specimens		Axial Sections UA2280	UA2281	UA2282	UA2283	UA2284	UA2285	UA2286	UA2287	UA2288
	1	.53	.37	.39	.22	-	.28	.13	.17	.34
	2	1.15	-	.82	.55	.56	.61	.32	.45	.67
HL	3	-	.89	-	1.08	.85	1.33	.53	.89	1.25
	4	-	1.22	-	1.51	-	-	.79	1.80	-
	5	-	1.80	-	2.50	-	3.78	1.62	3.18	3.74
	6	-	-	4.61	3.75	-	-	2.95	4.64	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	3.40	-	-	-	-
	1	.28	.16	.19	.15	.13	.16	.09	.10	.18
	2	.43	.23	.28	.24	.19	.26	.14	.19	.28
RV	3	-	.32	.40	.31	.26	.40	.21	.31	.42
	4	-	.43	-	.43	.34	.56	.30	.46	.62
	5	-	.57	-	-	.46	-	.42	.71	.86
	6	-	-	.90	-	.61	-	.67	1.03	-
	7	-	-	-	-	.81	-	.94	-	-
	8	-	-	-	-	.99	-	-	-	-
	1	44.6	7.2	10.5	19.3	-	22.0	9.9	12.7	16.5
	2	58.9	13.2	19.3	29.2	12.1	32.5	13.2	18.7	31.4
PT	3	-	24.8	29.7	-	16.0	38.5	30.3	36.9	49.5
	4	-	35.8	53.9	49.5	24.8	57.8	32.5	58.9	60.5
	5	-	46.8	-	-	44.6	71.0	41.3	93.5	89.1
	6	-	-	60.5	-	44.6	-	66.6	96.3	-
	7	-	-	-	-	55.0	-	-	-	-
	8	-	-	-	-	72.1	-	-	-	-

Table 17e, Part 1. Measurements of <u>Eoparafusulina</u> <u>(Eoparafusulina)</u> <u>mendenhalli</u> Petocz, n. sp.

		Axial Sections								
Specimens		UA2280	UA2281	UA2282	UA2283	UA2284	UA2285	UA2286	UA2287	UA2288
	0	.13	.08	-	.06	-	.09	.05	.05	-
	1	.20	.15	.14	.12	-	.21	.07	.11	.20
TW	2	-	-	.56	-	-	.29	.09	.15	.34
	3	-	-	-	-	-	-	-	.55	.66
	4	-	-	-	.58	-	.79	-	.97	1.09
	5	-	-	-	.90	-	-	1.00	1.12	-
	6	-	-	-	-	-	-	1.25	-	-
	1	1.86	2.32	2.06	1.52	-	1.76	1.51	1.62	1.92
	2	2.65	-	2.95	2.26	2.94	2.31	2.19	2.38	2.40
FR	3	-	2.79	-	3.43	3.25	3.31	2.52	2.86	2.95
	4	-	2.82	-	3.54	-	-	2.67	3.88	-
	5	-	3.13	-	-	-	-	3.84	4.48	4.32
	6	-	-	5.13	-	-	-	4.41	4.48	-
	7	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	3.41	-	-	-	-
	1									
	2	52.9	46.8	46.4	65.8	49.1	67.2	62.6	80.6	57.1
TS	3	-	35.3	43.5	28.4	35.7	51.9	45.9	65.5	51.7
	4	-	36.2	-	36.0	30.4	39.0	40.2	49.6	46.9
	5	-	33.2	-	-	37.0	-	42.1	52.9	39.2
	6	-	-	-	-	32.1	-	58.5	45.9	-
	7	-	-	-	-	31.9	-	39.8	-	-
	8	-	-	-	-	22.8	-	-	-	-
Pro.	Max.	310.2	224.4	246.4	229.4	183.2	185.9	227.7	131.5	225.5
	Min.	242.0	202.4	238.2	182.1	162.3	179.9	187.6	126.5	206.3

Table 17e, Part 2. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		Axial Sections UA2289	UA2290	UA2291	UA2292	UA2293	UA2294	UA2295	UA2296	UA2297
HL	1	.25	.42	.44	.29	.13	.13	.24	.15	.47
	2	.59	.93	.73	.46	.35	.34	.45	.30	.75
	3	.94	1.51	1.05	-	.89	.62	.97	.67	1.33
	4	-	1.97	-	1.51	1.70	.94	1.63	-	2.14
	5	2.24	3.43	2.00	2.07	-	1.53	2.66	-	3.14
	6	-	-	2.89	2.85	-	2.22	4.00	2.15	4,49
	7	-	6.24	4.27	4.81	-	-	6.20	-	5.23
	8	-	-	5.26	-	-	-	-	-	-
RV	1	.12	.20	.17	.15	.14	.13	.18	.12	.16
	2	.18	.26	.25	.21	.21	.21	.24	.17	.23
	3	.26	.38	.34	.28	.34	.29	.33	-	.33
	4	.40	.54	.48	.40	.50	.40	.43	.32	.46
	5	.57	.72	.65	.54	.70	.55	.60	.44	.62
	6	-	1.07	.88	-	-	-	.84	.60	.84
	7	-	1.48	1.18	-	-	-	-	-	1.15
	8	-	-	-	-	-	-	-	-	-
PT	1	9.9	-	13.8	11.6	14.3	17.1	-	6.1	14.3
	2	29.2	35.2	31.4	16.0	12.7	18.7	14.9	13.8	18.7
	3	36.9	49.5	35.2	20.9	31.4	-	22.6	-	22.6
	4	65.5	55.0	42.9	45.7	78.7	29.2	45.1	26.4	40.7
	5	59.4	72.1	53.4	53.9	67.1	44.0	49.0	-	41.8
	6	-	69.9	96.3	-	-	-	63.3	60.5	-
	7	-	94.1	-	-	-	-	88.0	-	90.2
	8	-	-	-	-	-	-	-	-	-

Table 17f, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		UA2289	UA2290	UA2291	UA2292	UA2293	UA2294	UA2295	UA2296	UA2297
		Axial Sections								
TW	0	-	-	-	.04	.06	.06	-	-	.10
	1	.10	.14	-	-	.10	.10	-	.08	.16
	2	-	-	-	.07	.19	.17	-	.21	.22
	3	.21	-	-	.19	.54	.48	-	-	.39
	4	.39	-	.51	.29	.77	.57	1.20	-	.78
	5	-	-	.86	.82	1.30	.61	-	-	1.32
	6	-	-	.75	-	-	-	-	-	-
FR	1	2.07	2.14	2.63	1.95	.90	.97	1.34	1.24	2.94
	2	3.33	3.56	2.87	2.23	1.66	1.67	1.90	1.73	3.19
	3	3.56	3.99	3.12	-	2.65	2.14	2.92	-	4.02
	4	-	3.67	-	3.81	3.41	2.34	3.77	-	4.62
	5	3.95	4.77	3.06	3.80		2.78	4.44	-	5.03
	6	-	-	3.27	-	-	-	4.76	3.58	5.36
	7	-	4.20	3.63	-	-	-	-	-	4.54
	8	-	-	-	-	-	-	-	-	-
TS	1									
	2	49.4	32.8	53.1	39.0	53.4	60.9	31.3	46.1	46.0
	3	49.6	44.0	32.9	35.4	59.1	39.1	39.8	-	41.4
	4	51.6	41.6	41.4	42.1	47.7	40.2	29.6	-	40.0
	5	40.9	34.2	36.5	37.5	41.0	36.4	38.2	38.2	34.3
	6	-	48.7	35.2	-	-	-	40.4	37.2	34.4
	7	-	38.8	33.6	-	-	-	-	-	37.4
	8	-	-	-	-	-	-	-	-	-
Pro.	Max.	175.5	287.1	123.2	165.0	212.9	187.0	248.6	176.6	234.9
	Min.	145.2	-	-	122.7	174.4	182.1	217.3	163.9	218.4

Table 17f, Part 2. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		Axial Sections							
		UA2298	UA2299	UA2300	UA2301	UA2302	UA2303	UA2304	UA2305
	1	.39	.29	.26	.25	.31	.22	.19	.21
	2	.61	.55	.46	.77	.56	.46	.43	.42
HL	3	1.02	1.17	.88	1.13	1.03	.86	.71	.77
	4	1.73	2.07	1.68	1.59	1.38	1.49	1.07	1.10
	5	2.76	3.04	2.57	2.22	2.34	2.25	1.61	1.90
	6	-	4.10	3.85	-	3.37	-	3.12	-
	7	-	-	5.51	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
	1	.17	.14	.18	.17	.12	.12	.10	.11
	2	.25	.22	.24	.25	.19	.18	.17	.19
RV	3	.35	.32	.34	.32	.29	.29	.28	.26
	4	.46	.48	.48	.44	.42	.43	.43	.43
	5	.63	.64	.67	.58	.63	.62	.61	.62
	6	-	.94	.88	-	.91	-	.84	-
	7	-	-	1.16	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
	1	11.6	12.1	11.6	12.1	15.4	12.7	16.0	12.7
	2	20.9	28.6	14.9	14.3	18.7	18.7	18.2	23.1
PT	3	45.1	28.6	28.1	26.4	46.8	31.4	25.9	28.1
	4	28.6	41.8	34.7	39.1	50.6	45.7	31.4	45.1
	5	69.9	36.9	57.8	-	77.0	-	36.9	56.7
	6	-	81.4	35.2	-	85.3	-	-	-
	7	-	-	83.1	-	-	-	-	-
	8	-	-	-	-	-	-	-	-

Table 17g, Part 1. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		UA2298	UA2299	UA2300	UA2301	UA2302	UA2303	UA2304	UA2305
		Axial Sections							
TW	0	.10	.08	.06	.09	.06	.07	.05	.06
	1	.17	.12	.15	.13	.10	.11	.09	.09
	2	.22	.20	.28	.22	.18	.17	.19	.14
	3	.33	.39	.39	.47	.28	.30	.25	.27
	4	.81	1.09	.54	.62	.43	.46	-	.43
	5	-	1.32	-	-	.85	.88	.88	-
	6	-	-	1.65	-	-	-	-	-
FR	1	2.26	2.06	1.48	1.50	2.69	1.87	1.82	1.90
	2	2.46	2.45	1.93	3.12	2.91	2.49	2.48	2.16
	3	2.90	3.67	2.59	3.54	3.58	2.95	2.50	2.93
	4	3.78	4.33	3.47	3.60	3.29	3.45	2.45	2.53
	5	4.41	4.71	3.85	3.82	3.71	3.64	2.65	3.07
	6	-	4.38	4.36	-	3.71	-	3.72	-
	7	-	-	4.73	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
TS	1								
	2	41.9	60.3	34.1	46.4	63.8	59.7	64.6	68.7
	3	41.8	42.4	42.6	29.2	49.6	57.1	65.6	35.7
	4	30.5	49.5	43.0	38.8	46.2	47.9	52.4	65.1
	5	36.8	35.0	37.6	31.4	50.3	43.3	39.7	42.1
	6	-	45.1	32.4	-	44.3	-	37.8	-
	7	-	-	31.7	-	-	-	-	-
	8	-	-	-	-	-	-	-	-
Pro.	Max.	262.9	193.6	183.2	252.5	171.1	189.2	139.2	209.6
	Min.	226.1	177.1	162.3	234.9	155.1	164.5	137.5	141.9

Table 17g, Part 2. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

		Sagittal Sections								
Specimens		UA2306	UA2307	UA2308	UA2309	UA2310	UA2311	UA2312	UA2313	UA2314
RV	1	.307	.333	.230	.218	.241	.186	.216	.260	.265
	2	.427	.461	.336	.322	.345	.302	.306	.393	.445
	3	.574	.748	.496	.467	.476	.443	.409	.574	.627
	4	.755	1.010	.698	.608	.631	.560	.568	.802	.865
	5	1.020	-	.898	.892	.850	-	.759	-	1.242
	6	1.242	-	1.166	-	1.146	-	-	-	1.610
PT	1	26.4	25.3	13.8	16.0	26.4	24.8	25.9	14.9	22.0
	2	25.9	33.0	-	23.7	30.3	45.1	33.6	26.4	23.7
	3	32.5	40.7	39.6	42.4	36.9	45.1	30.8	49.5	35.8
	4	44.6	62.7	-	51.2	51.2	-	50.1	64.4	38.5
	5	46.8	-	71.0	86.9	51.2	-	62.7	-	65.5
	6	54.5	-	-	-	80.3	-	-	-	84.2
SC	1	8	10	-	11	10	7	10	10	8
	2	16	15	-	13	17	10	16	16	13
	3	17	17	-	14	15	15	15	19	18
	4	21	16	-	15	21	-	20	24	18
	5	20	-	-	19	25	-	19	-	19
	6	19	-	29	-	29	-	-	-	26
	7	21	-	33	-	-	-	-	-	-
Pro.	Max.	199.7	325.6	219.5	246.4	312.4	219.5	242.6	280.0	165.0
	Min.	169.4	266.8	207.9	213.4	228.3	194.2	214.0	275.0	155.7

Table 17h. Measurements of Eoparafusulina (Eoparafusulina) mendenhalli Petocz, n. sp.

Specimens		UA2315	UA2316	UA2317	UA2318	UA2319	UA2320
		Sagittal Sections					
RV	1	.207	.220	.110	.170	.192	.181
	2	.307	.344	.181	.272	.280	.286
	3	.436	.479	.280	.437	.390	.409
	4	.583	.653	.394	.684	.528	-
	5	.806	.904	.585	-	.699	-
	6	1.136	-	-	-	.985	-
PT	1	12.1	-	9.9	12.1	16.5	-
	2	25.9	29.7	14.3	29.7	23.1	24.8
	3	29.7	42.4	22.0	47.3	28.1	41.8
	4	45.7	50.1	30.8	53.4	39.1	-
	5	79.2	72.1	44.0	-	46.2	-
	6	88.6	-	-	-	71.5	-
SC	1	11	9	8	10	8	10
	2	16	14	10	13	13	16
	3	16	17	14	14	16	18
	4	19	19	16	17	17	-
	5	20	19	17	-	19	-
	6	24	24	-	-	-	-
	7	-	-	-	-	-	-
Pro.	Max.	224.4	186.5	133.7	166.7	220.0	223.3
	Min.	198.0	-	113.3	151.8	189.2	197.5

Table 17i. Measurements of <u>Eoparafusulina</u> <u>(Eoparafusulina)</u> <u>mendenhalli</u> Petocz, n. sp.

Specimens		Axial Sections								
		UA2375	UA2376	UA2377	UA2378	UA2379	UA2380	UA2381	UA2382	UA2383
HL	1	.23	.19	.20	.22	.36	.28	.20	.15	.29
	2	.37	.45	.43	.48	.80	.58	.48	.42	.61
	3	.62	.81	.70	.89	1.40	1.19	.89	.83	1.12
	4	1.10	1.32	1.22	1.54	2.79	2.04	1.30	1.37	1.40
	5	2.07	2.28	2.26	2.33	4.20	4.13	2.07	2.30	2.32
	6	3.38	-	-	3.66	-	-	3.28	3.46	3.77
	7	4.48	-	-	-	-	-	-	-	-
RV	1	.10	.14	.11	.12	.20	.20	.14	.16	.16
	2	.15	.22	.17	.18	.30	.34	.22	.26	.24
	3	.24	.36	.27	.31	.48	.49	.31	.38	.34
	4	.38	.54	.42	.47	.73	.70	.44	.55	.47
	5	.56	.80	.63	.71	1.09	1.03	.60	.81	.70
	6	.77	.90	.89	1.11	-	-	.82	1.14	.99
	7	-	-	1.05	1.38	-	-	-	-	-
PT	1	7.2	9.9	8.8	9.9	18.7	17.1	13.2	11.6	17.6
	2	12.1	19.8	18.7	19.8	44.6	35.8	16.5	14.3	30.3
	3	24.8	44.0	35.8	41.3	68.8	45.1	30.8	46.2	39.1
	4	47.3	48.4	72.1	51.7	79.2	60.0	38.0	56.1	49.5
	5	68.8	76.5	111.2	75.4	82.0	80.3	64.4	85.8	79.8
	6	60.5	-	122.2	80.3	-	-	63.8	96.8	99.0
	7	-	-	80.9	-	-	-	-	-	-

Table 18a, Part 1. Measurements of _Eoparafusulina_ (_Eoparafusulina_) _waddelli_ Petocz, n. sp.

		Axial Sections								
Specimens		UA2375	UA2376	UA2377	UA2378	UA2379	UA2380	UA2381	UA2382	UA2383
TW	0	.05	-	.05	.05	.06	-	.05	.07	.07
	1	.07	.10	.09	.09	.23	.13	.09	.11	.14
	2	.12	.12	.16	.14	.36	.28	.17	.18	.28
	3	.20	.28	.28	.23	.91	.55	.26	.41	.33
	4	.31	.60	.39	.48	2.05	1.62	.65	.79	.61
	5	.65	-	1.23	-	-	-	1.71	1.65	.82
FR	1	2.34	1.33	1.75	1.92	1.78	1.39	1.39	.94	1.84
	2	2.40	2.05	2.45	2.67	2.65	1.70	2.19	1.57	2.57
	3	2.57	2.27	2.56	2.85	2.93	2.41	2.86	2.15	3.31
	4	2.86	2.47	2.91	3.29	3.83	2.92	2.92	2.51	2.96
	5	3.69	2.85	3.55	3.27	3.87	4.00	3.44	2.83	3.28
	6	4.40	-	-	3.29	-	-	4.00	3.04	3.82
	7	-	-	-	-	-	-	-	-	-
TS	1	57.0	50.7	53.7	53.6	47.7	67.7	53.9	61.2	50.4
	2	55.3	63.7	56.7	74.3	59.0	43.7	41.5	45.4	43.3
	3	60.5	49.6	52.7	50.6	52.9	41.4	43.7	41.8	39.7
	4	45.3	48.9	51.2	51.7	48.9	47.5	35.6	49.1	49.1
	5	37.2	12.6	40.0	56.4	-	-	35.9	39.9	39.9
	6	-	-	18.0	24.5	-	-	-	-	-
	7									
Pro.	Max.	138.6	214.0	170.5	151.3	277.2	319.6	226.6	267.9	237.6
	Min.	137.0	199.1	160.6	145.2	243.7	280.5	188.1	172.2	227.7

Table 18a, Part 2. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

		Axial Sections								
Specimens		UA2384	UA2385	UA2386	UA2387	UA2388	UA2389	UA2390	UA2391	UA2392
	1	.31	.23	.36	.20	.33	.24	.19	.22	.16
	2	.75	.49	.81	.43	.69	.55	.45	.45	.39
HL	3	1.32	1.05	1.64	.76	1.19	.99	.81	.75	.89
	4	2.45	1.75	2.51	1.08	1.92	1.48	1.19	1.23	1.58
	5	3.72	2.65	-	1.80	2.93	2.21	1.76	1.94	2.83
	6	-	-	-	2.74	-	3.04	2.80	2.86	4.02
	7	-	-	-	-	-	-	3.79	-	-
	1	.19	.15	.15	.10	.17	.14	.11	.13	.16
	2	.28	.26	.24	.16	.24	.24	.18	.19	.24
RV	3	.40	.40	.37	.23	.36	.34	.29	.27	.37
	4	.57	.59	.52	.34	.52	.49	.41	.40	.51
	5	.85	.85	-	.50	.74	.69	.60	.63	.70
	6	1.16	-	-	.71	-	.93	.85	.98	.96
	7	-	-	-	-	-	-	1.23	-	-
	1	16.5	12.1	13.8	9.4	12.1	21.5	11.6	12.7	13.8
	2	37.4	37.4	36.9	16.5	23.7	35.2	16.0	11.0	28.1
PT	3	51.7	45.7	44.6	24.8	71.0	44.0	35.8	22.0	39.6
	4	68.2	51.2	50.6	38.5	61.6	68.8	43.5	62.2	60.5
	5	74.8	48.4	-	53.9	80.3	59.4	74.3	-	71.0
	6	-	-	-	68.8	-	55.6	78.1	79.8	90.2
	7	-	-	-	-	-	-	-	-	-

Table 18b, Part 1. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

		Axial Sections								
Specimens		UA2384	UA2385	UA2386	UA2387	UA2388	UA2389	UA2390	UA2391	UA2392
TW	0	.04	.07	.08	.05	.09	.06	.04	-	.04
	1	.19	.14	.18	.09	.14	.13	.08	.07	.10
	2	.36	.45	.29	.19	.24	.22	-	.13	.16
	3	.59	.52	.67	.34	.56	.95	.25	.18	.35
	4	.82	-	-	.46	.67	.74	.52	.43	.72
	5	-	-	-	.91	-	.97	1.08	1.03	1.83
FR	1	1.63	1.49	2.42	2.08	1.98	1.68	1.75	1.73	.97
	2	2.66	1.90	3.37	2.77	2.86	2.31	2.42	2.38	1.63
	3	3.33	2.59	4.37	3.36	3.31	2.90	2.75	2.82	2.42
	4	4.27	2.94	4.82	3.16	3.67	3.02	2.88	3.05	3.08
	5	4.36	3.11	-	3.60	3.97	3.20	2.91	3.11	4.03
	6	-	-	-	3.87	-	3.26	3.32	2.91	4.18
	7	-	-	-	-	-	-	3.07	-	-
TS	1	49.9	67.4	60.2	61.7	43.6	69.4	70.2	44.7	47.9
	2	40.2	56.4	54.9	45.6	47.9	43.2	59.5	42.7	52.3
	3	44.3	47.1	39.0	50.9	45.7	42.6	40.0	50.9	39.9
	4	48.7	43.2	-	45.4	40.7	41.9	46.0	54.9	36.3
	5	36.1	-	-	41.6	-	34.8	39.9	57.2	37.2
	6	-	-	-	-	-	-	45.8	-	-
	7									
Pro.	Max.	199.7	205.7	254.1	156.2	259.1	179.9	157.3	168.9	223.3
	Min.	168.9	205.2	138.6	138.6	221.7	168.9	149.6	167.8	196.4

Table 18b, Part 2. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

Specimens		UA2393	UA2394	UA2395	UA2396	UA2397	UA2398	UA2399	UA2400	UA2401
		Axial Sections								
HL	1	.13	.26	.16	.28	.19	.23	.21	.26	.20
	2	.46	.63	.35	.54	.47	.50	.47	.59	.51
	3	.82	1.14	-	.89	.73	.88	.88	1.10	.92
	4	1.53	1.96	-	1.21	1.48	1.48	1.31	1.94	-
	5	2.51	3.12	-	2.01	2.50	2.13	1.95	3.07	-
	6	4.19	4.48	-	2.87	-	3.08	-	-	-
	7	-	-	-	-	-	3.99	-	-	-
RV	1	.17	.17	.13	.13	.15	.17	.13	.13	.15
	2	.29	.25	.18	.20	.23	.25	.20	.23	.25
	3	.43	.41	-	.29	.36	.34	.33	.34	.39
	4	.59	.62	-	.43	.53	.48	.54	.51	.58
	5	.83	.86	-	.60	.81	.66	.78	.76	-
	6	1.12	-	-	.83	-	.90	-	-	-
	7	-	-	-	-	-	1.22	-	-	-
PT	1	22.0	22.6	9.9	12.1	12.1	12.7	17.1	20.9	18.7
	2	38.5	41.3	22.6	13.2	25.9	22.0	27.0	28.1	30.8
	3	51.7	47.3	-	30.3	45.1	30.8	32.5	53.4	38.5
	4	63.3	58.3	-	46.8	61.6	51.7	75.4	81.4	66.0
	5	91.9	-	-	62.2	74.8	62.2	64.4	82.0	-
	6	55.6	-	-	82.5	-	99.0	-	-	-
	7	-	-	-	-	-	106.2	-	-	-

Table 18c, Part 1. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

		Axial Sections								
Specimens		UA2393	UA2394	UA2395	UA2396	UA2397	UA2398	UA2399	UA2400	UA2401
TW	0	.06	.06	.05	.06	.07	.05	.05	.06	-
	1	.09	.15	.08	.09	.11	.11	.08	.15	.10
	2	.15	.21	-	.18	.19	.20	.11	.24	.18
	3	.46	.76	-	.33	.37	.30	.35	.68	.59
	4	.74	1.30	-	.80	.83	.72	-	.90	-
	5	.85	.18	-	1.03	-	-	-	-	-
FR	1	.76	1.53	1.29	2.17	1.24	1.36	1.67	1.94	1.28
	2	1.59	2.53	1.93	2.72	2.06	2.04	2.30	2.61	2.09
	3	1.90	2.80	-	3.03	2.02	2.55	2.65	3.28	2.35
	4	2.59	3.15	-	2.79	2.77	3.08	2.42	3.79	-
	5	3.03	3.61	-	3.36	3.09	3.24	2.51	4.03	-
	6	3.73	-	-	3.44	-	3.42	-	-	-
	7	-	-	-	-	-	3.28	-	-	-
TS	1									
	2	66.8	45.5	41.1	51.9	49.3	45.1	62.2	67.5	59.3
	3	50.2	62.2	-	48.5	57.9	40.1	62.7	48.1	58.9
	4	36.3	53.2	-	46.9	47.2	39.0	62.6	52.3	48.0
	5	39.7	38.6	-	38.3	51.8	37.3	44.1	48.2	-
	6	36.1	-	-	39.8	-	37.0	-	-	-
	7	-	-	-	-	-	34.9	-	-	-
Pro.	Max.	240.9	214.0	204.6	194.7	214.0	265.1	179.3	206.3	238.2
	Min.	203.5	138.6	179.3	152.9	204.6	206.8	178.8	183.7	211.2

Table 18c, Part 2. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

Specimens		Axial Sections UA2402	UA2403
HL	1	.11	.22
	2	.33	.48
	3	.62	.95
	4	.96	1.71
	5	-	-
	6	-	-
	7	-	-
RV	1	.10	.14
	2	.17	.23
	3	.26	38
	4	-	.57
	5	-	-
	6	-	-
	7	-	-
PT	1	16.5	16.5
	2	18.2	20.9
	3	41.8	50.1
	4	-	79.8
	5	-	-
	6	-	-
	7	-	-

Table 18d, Part 1. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

Specimens		Axial Sections UA2402	UA2403
TW	0	.03	.05
	1	.07	.12
	2	.15	.28
	3	-	.51
	4	-	-
	5	-	-
FR	1	1.04	1.52
	2	1.94	2.14
	3	2.37	2.52
	4	-	2.98
	5	-	-
	6	-	-
	7	-	-
TS	1	62.1	59.2
	2	54.6	65.7
	3	-	51.9
	4	-	-
	5	-	-
	6	-	-
	7		
Pro.	Max.	154.6	191.4
	Min.	121.0	177.7

Table 18d, Part 2. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.

Specimens		Sagittal Sections UA2404	UA2405	YA2406	UA2407
RV	1	.175	.186	.166	.190
	2	.268	.287	.261	.294
	3	.375	.390	.381	.431
	4	.522	.552	.573	.601
	5	-	-	.813	.798
	6	-	-	1.089	-
PT	1	15.4	19.8	15.4	20.9
	2	20.9	26.4	25.3	34.1
	3	28.1	37.4	36.9	48.4
	4	38.5	-	63.3	57.2
	5	-	-	79.2	67.1
	6	-	-	64.9	-
SC	1	9	9	7	7
	2	12	11	12	13
	3	14	15	16	16
	4	16	-	19	17
	5	-	-	18	20
Pro.	Max.	188.7	192.0	195.3	189.2
	Min.	172.2	169.4	167.8	165.6

Table 18e. Measurements of Eoparafusulina (Eoparafusulina) waddelli Petocz, n. sp.